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TRANSACTIONS

OF

THE ZOOLOGICAL SOCIETY.

I. *Supplement to "A Synopsis of the Fishes of Madeira*." By the Rev.* R. T. Lowe, *M.A., Corr. Memb. of the Zool. Soc.*

Communicated May 28, 1839.

Fam. Percidæ.

Genus Callanthias.

Gen. Char.—Head scaly, except the short muzzle before the eyes; teeth as in *Anthias*, Bl.; preopercle perfectly entire; opercle with two flat adpressed spines; lateral line high up, near the back, and ending at the end of the dorsal fin, which is even or continuous; branchiostegous membrane with six rays.

Callanthias paradisæus. A most elegant little fish; in general habit and colouring resembling *Anthias sacer*, Bl., but without the produced third spine of the dorsal fin. Its analogies are singularly complicated, but its affinities are truly Percidous. By Bloch it might have been arranged either in *Bodianus* or *Cephalopholis*, Bl., but it is really inadmissible into any well-defined or constituted modern genus. It is almost as rare as beautiful.

Fam. Berycidæ.

Genus Beryx, Cuv.

Beryx decadactylus, Cuv. *B. corpore ovali, lato, profundo, altitudine longitudinem capitis superante; dorso elevato, arcuato, gibbo; ventre prominente: basi pinnæ*

* Published in the Transactions of the Zoological Society, vol. ii. p. 173.

dorsalis elongato, pinnis pectoralibus haud breviore: oculis maximis: operculi angusti carinâ obscurâ: osse humerali angusto, margine posteriore recto, verticali.

D. 4 + 18 – 20; V. 1 + 10; &c.

B. decadactylus, Cuv. et Val., Hist. III. 222.

B. splendens, nob. quoad icon. Tab. III. in Camb. Phil. Trans., Vol. VI. Part 1; haud textus.

When I published *B. splendens* as a new species in the Cambridge Transactions, I was unacquainted with the present fish, though it is scarcely perhaps less common than the former. I consequently did not discover till long after, that the figure intended for my *B. splendens* had been inadvertently taken by Miss Young from an individual of *B. decadactylus*, Cuv., of which it offers the more obvious peculiarities. The true *B. splendens*, therefore, yet remains unfigured, and till an opportunity presents of supplying this deficiency in the "Fishes of Madeira," I subjoin its true specific characters, contrasted with those of *B. decadactylus*.

B. SPLENDENS. *B. corpore oblongo, altitudine longitudinem capitis haud æquante: dorso recto: basi pinnæ dorsalis brevi, pinnis pectoralibus breviore: oculis magnis; capite utrinque pone oculos gibboso: operculi lati carinâ prominente: osse humerali dilatato, margine posteriore arcuato, obliquo.*

D. 4 + 13 – 15; V. 1 + 10 – 13 (1 + 11 fere); &c.

B. splendens, nob. Proceed. Zool. Soc. 1833. 1. 142. Camb. Phil. Trans. VI. 1. 197; excl. icon.—Syn. Mad. Fishes in Trans. Zool. Soc. Vol. ii. p. 174.

Trachichthys pretiosus, nob.

Hoplostethus mediterraneus, Cuv. et Val. IV. 496. t. 97. bis. Rariss.

This fish is unquestionably congeneric, if it is not even still more closely allied with *Trachichthys australis* of Shaw. Hence the above adoption of the older generic appellation, affording opportunity for the substitution of a less restrictive specific title; better suited to a fish: proved by the occurrence of two individuals in these Atlantic seas not to be peculiarly Mediterranean.

To the Sub-Percidous family *Berycidæ* belongs also *Polymixia*; nob. Camb. Phil. Trans. IV. 1. 198. t. IV.—Syn. Mad. Fish. pp. 178, 179.

Fam. TRIGLIDÆ.

SCORPÆNA USTULATA. *S. minor, laciniis nullis, rubra, pallido variegata nigroque punctata; genis operculisque granulato-pustulosis, maculâ fuscâ notatis: pinnæ dorsalis medio unimaculatæ spinâ quartâ ceteris longiore: capite s. rostro abbreviato, obtuso; maxillis æqualibus: squamis majusculis, scabriusculis.*

D. 12 + 9; A. 3 + 5; P. 1 + VII. + 10; V. 1 + 5; C. $\frac{5 + \text{VI.}}{5 + \text{V.}}$

Rariss.

Occasionally taken with the common sort (*Sc. scrofa*, L.), with which it agrees in general colouring, resembling rather the Rocaz (*Sebastes maderensis*, nob.) in shape. It appears undescribed, and is very distinct in its characters, being a true *Scorpæna*, notwithstanding the absence of *laciniæ*, having the whole head naked or scaleless. It scarcely attains half the size of *Sc. scrofa*, L.

Trigla lineata, L. Cuv. et Val. Hist. IV. 34.; Yarrell, Brit. Fish. 1. 46. Rariss.

A single individual only has occurred.

Fam. Sparidæ.

Pagellus rostratus, nob.—Syn. Mad. Fish. 177.

Reference to the excellently characteristic figures of Rondelet and Salviani has satisfied me that this is merely *Pagellus erythrinus*, Cuv. and Val.

Fam. Chœtodontidæ.

Pimelepterus Boscii, Lac.—"*Cheiroco*" or "*Xarroco.*"—Cuv. et Val. VII. 258. t. 187. Rariss.

Fam. Scombridæ.

Nauclerus abbreviatus, Cuv. et Val. Hist. IX. 251.

Two individuals have occurred of this pretty little fish, answering so well to the species above referred to, that it were unreasonable to doubt their identity, although its describers have omitted mentioning a strong superscapulary spine, and a fourth smaller tooth or spinule along the lower border of the preopercle, anterior to the three which arm its angle. Alive, and in a glass of sea-water, the activity and lovely colours of these little fishes rendered them most interesting objects. They were taken following a piece of floating timber; and until close examination after death, could scarcely be distinguished from the young of *Naucrates ductor*, Cuv., but for the absence of the caudal keels.

Tetrapturus Georgii.—"*Peito.*"

Having at length, through Mr. Leacock's kind exertions, obtained a fine example of the *Peito* in perfect condition, I am enabled to state that it forms a new and very distinct species of *Tetrapturus*, Rafin.; differing from *T. belone*, Raf., as described by MM. Cuvier and Valenciennes, especially in having the pectoral fins proportionally twice as long, and the body clothed with large scales of a peculiar shape and nature. I only forbear to draw up its specific character till I have checked my notes and observations by examination of more examples; but I hope to be allowed the privilege at once of commemorating by its specific name the valuable assistance rendered to the cause of Ichthyology by Mr. George Butler Leacock of this island, generally, as well as in the present instance.

Thynnus Albacora.—"*Atum Albacora.*"—*T. corpore elongato, postice attenuato: pinnâ anali secundâque dorsali antice longe falcato-productis: pectoralibus ad medium secundæ dorsalis attingentibus: ore oculisque parvis.*

Tunny, Penn. Brit. Zool. Ed. 1. iii. 266. No. 133. t. 52. excl. syn. An L'Auxide de Sloane, Scomber Sloanei, Cuv. et Val. Hist. VIII. 148; i. e. Albacore, Sloane, Hist. of Jam. 1. t. 1. f. p. 28? Sat. vulg.

The length of the narrow produced fore-part of the second dorsal fin varies from one-sixth to one-fourth part of the whole length of the fish; that of the pectoral fins is from one-fifth to one-fourth part of the same, and their tips reach to the middle of the second dorsal fin. Thus, in this latter point it is intermediate between the common Tunny (*T. vulgaris*, L.) and the following new species (*T. obesus*, nob.); approaching most the latter.

Pennant's figure is at least a tolerable representation of this very distinct species, agreeing with it in its main points of difference from the true *T. vulgaris*, L. It may be hoped that the attention of British Naturalists will be directed to this point. The proper season for the Albacora in Madeira is September and October.

THYNNUS OBESUS.—"*Atum Patudo.*"—*T. corpore abbreviato, obeso: pinnis acutis; pectoralibus ad finem secundæ dorsalis attingentibus: oculis magnis.*

Vulgaris.

This fish is constantly distinguished by the fishermen from the common Tunny or "*Atum Rabilha*" (*T. vulgaris*, L.) by the larger eye, and shorter thickset figure. The pectoral fins vary from one-fourth to nearly one-sixth part of the whole length, their points reaching to the end of the second dorsal fin. In *T. vulgaris*, L. the tips of the pectoral fins reach only to the end of the first, or to the beginning of the second dorsal fin.

T. obesus is in greater abundance earlier in the summer than *T. Albacora*. In size it ranges next below *T. vulgaris*, L., not however attaining above half the extreme size of that species; nor much exceeding the full size of *T. Albacora*.

Thynnus Alalonga, Cuv. et Val.—"*Atum Avoador.*"—Cuv. et Val. Hist. VIII. 120. t. 215.

Orcynus Alalonga, Risso, iii. 419. Vulgaris.

No difficulty can occur in the recognition of this species, from the great length of the pectoral fins, which are one-third part of the whole length, and reach to the end of the anal fin, or to the first spurious finlet behind it. Its proper season is said to be January.

Gen. APHANOPUS, nob.

Gen. Char.—Form as in *Lepidopus*, elongate, much compressed, like a sword-blade, naked, but with a short keel on each side, towards the tail.

Muzzle and teeth as in *Lepidopus* (Gouan), but the palatines unarmed.

Dorsal fins two, nearly equal. Anal fin as in *Lepidopus*, but with a strong sharp spine instead of a scale before it, a little behind the vent. No trace or rudiment of ventral fins.

APHANOPUS CARBO.—"*Espada preta.*" Rariss.

Of this most curious new genus a single individual only has yet occurred. The whole fish is of a dark coffee colour, approaching to black, and has in form so close a general resemblance to *Lepidopus argyreus*, Cuv., that it might well be taken hastily for a mere variety of that fish.

Tetragonurus atlanticus, nob.

Differs from *T. Cuvieri*, Cuv. and Val., XI. 172. *t.* 318. chiefly in the longer head, much larger eye (nearly twice as large in proportion to the whole length), greater width between the eyes, teeth twice as numerous, in the upper jaw; thicker body, longer pectoral fins, higher (twice as high) first dorsal fin, and inequality of its spines. Having, however, seen only a single individual, I forbear to characterize it more distinctly; especially since of *T. Cuvieri* so few examples have as yet occurred; and that even MM. Cuvier and Valenciennes appear to have taken their figure from one which was imperfect in the caudal fin at least. The first dorsal fin is described by MM. Cuvier and Valenciennes as having fifteen spines; but twenty-one are figured in the plate.

The following is the fin formula of *T. Cuvieri,* according to Risso; and MM. Cuv. and Val.:

"1st. D. 18; 2nd. D. 1, 12; A. 1, 11; P. 16; V. 1, 5; C. 36."—Risso Hist.

"1st. D. $\left\{\begin{matrix}\text{15 in text,}\\ \text{21 in fig.}\end{matrix}\right\}$ 2nd. D. 1 + 13; A. 12; P?; V?; C?; B. M. 5."—Cuv. and Val. Hist.

That of *T. atlanticus*, nob. is

1st D. 15; 2nd. D. 11; A. 11.; P. 16; V. 1 + 5; C. $\frac{7 + \text{VIII.}}{7 + \text{VII.}}$; B. M. 5.

The true affinities of this fish are certainly rather to be sought among the Mackerels (*e. g. Thyrsites*) than the Mullets. Its relation to the *Mugilidæ* is, indeed, one merely of a faint analogy.

Xiphias gladius, L.—"*Peixe Agulha.*"

The ordinary Sword-fish of Madeira is truly the common *Xiphias gladius*, L.

I have heard, however, of "another sort, with a bayonet or spit-like beak," which may perhaps have been a *Histiophorus* or *Tetrapturus.*

SERIOLA DUBIA. Rariss.

A single individual only has occurred, which I am unable to identify with any of the species enumerated by MM. Cuv. and Val. The second dorsal fin is produced in front into a point; five-eighths the depth of the body beneath. The sides of the tail are sufficiently distinctly keeled; and there is no temporal band. In the first of these characters it comes nearest *S. Rivoliana* or *S. falcata*, Cuv. and Val.; differing, however, from both, principally in the points in which they are said to agree with *S. Dumerilii*, Cuv. and Val. With *S. Lalandi*, Cuv. and Val., it agrees in the two latter points above mentioned; but differs in the produced second dorsal and anal fins; *S. Lalandi* appearing from MM. Cuvier and Valenciennes' description not to disagree in this respect with *S. Dumerilii*, Cuv. and Val. The individual described measured two feet and a half long.

Lampris lauta. For "Vertebris 69" and "Vert. 49," in the specific character and following formula of the *Lampris lauta*, p. 183 of the Synopsis of Mad. Fish. (vol. ii. Trans. Zool. Soc. p. 183), read, Vertebris 45; and in the seventh line of the next page, for "six vertebræ more," read "two vertebræ more."

Fam. Coryphænidæ.

Coryphæna hippurus, Cuv. et Val.? "*Dourado macho.*"—Syn. Fish. Mad. 183.

This fish agrees with *C. hippuroïdes*, Raf., according to the brief account transcribed by MM. Cuv. and Val., in having a row of larger dusky spots along the ridge of the back on each side at the base of the dorsal fin, which is itself immaculate, whilst the anal fin is also somewhat high and pointed in front. In these three points it is at variance with MM. Cuvier and Valenciennes' elaborate description of their *C. hippurus*, L. The individual described, however, by these consummate Ichthyologists was a male; whilst the only three which I have been able to examine closely, proved on dissection to be females, though commonly supposed by the Maderan fisherman to be the male of *C. equisetis*, L. Hence the Maderan fish, whether identical or not with the obscure and doubtful *C. hippuroïdes*, Raf., is for the present better referred to *C. hippurus*, L. Sufficient ground appears for the suspicion that the above differences may be only sexual. But were it otherwise, they would alone scarcely warrant its specific discrimination.

Coryphæna Nortoniana.—"*Delfim.*"

This is a deeper fish than the preceding, in proportion to its length; with the front much steeper and bluffer; indeed, nearly vertical; the dorsal fin beginning also somewhat forwarder. In the fin-formulæ, and number of the vertebræ (31), the two agree; and I have seen too few individuals at present to decide whether they really are distinct, or only so in sex. But for its spotted body, I should be greatly tempted to refer it to the imperfectly known *C. imperialis*, Raf. (See Cuv. and Val., Hist. 9, 286.) In this uncertainty as to both rank and synonyms, less ultimate confusion will result from a distinct specific name, applied provisionally, than from a doubtful reference. It is therefore called after the Honourable C. E. C. Norton, to whose able pencil I was first indebted for a knowledge of the fish. Two other supposed individuals have since occurred, of which, however, one was unfortunately neglected, and the other had been too much injured by a blow, beating in the interparietal crest, to be fully satisfactory. This last individual, taken November 22nd 1838, was apparently a male; but I could not satisfy myself completely even on this point, and infer it only from my inability to discover any trace of the ovaria.

Coryphæna equisetis, L. 1, 447.—"Dourada," "*D. femea*," or "*D. amarella*."—*C. equisetis*, Cuv. et Val., 9, 297, *t.* 267.

This may at once be distinguished from the foregoing species by its unspotted body, marked only by a few scattered, clear, but extremely minute black specks, very different from the diffused, pale, dusky, larger spots of the preceding. The pectoral fins are also very short, the dorsal fin with fewer rays (53–55), the number of vertebræ greater (33), the form deeper and less elongated than even in the first species here recorded. It also is a smaller fish. Being our commonest species, I have seen numerous examples, but none exceeding two feet in length. The average length is very uniformly from twenty to twenty-two or twenty-three inches.

This fish, which is the commonest of the "Dourados" of Madeira, differs from *C. equisetis*, L., as described by MM. Cuv. and Val., under the name of *C. equisetis*, only in the head being rather longer than high, instead of higher than long, in the dorsal fin being lower in its highest part, and also lower *before* than *at* its hinder end; and lastly in the profile being oblique from the beginning, whilst in *C. equisetis*, Cuv. and Val., "il monte d'abord verticalement sur le tiers à peu près de son contour." The first three discrepancies might well be merely due to slightly different modes of measurement. The latter is less easily accountable; for in this Maderan fish at least, of which I am well acquainted with both sexes, I find nothing to confirm M. Dussumier's observation, that a greater height of the interparietal crest is characteristic of the male in *Coryphæna*. See Cuv. and Val. 12, Pref. p. vii.

Asteroderma coryphænoides (Bon.); *Astrodermus coryphænoides*, Cuv. et Val. IX. 353. *t.* 270.—*Diana semilunata*, Risso, Hist. iii. 267. *f.* 14.

A single small example only has occurred.

Pompilus Rondeletii, Will. 215, *t.* O. 1, *f.* 6.

Centrolophus pompilus, Yarr. 1, 158.

———— *pompilus*, Cuv. et Val. 9, 334, *t.* 269.

———— *morio* (Lacep.) Ib. 342. Rariss.

Two examples have occurred during the writing of this paper; the first was uniformly blackish, without spots or marks, thus answering to *Centrolophus Morio* of Lacepède: the second individual was smaller, and was marked precisely as in MM. Cuvier and Valenciennes' figure (t. 269.) of *C. pompilus*.

I have no hesitation in uniting both these fishes, with their respective synonyms, under the name long since applied by Willughby to designate the species; although by him employed especially in reference to the second state or variety above mentioned, which also was the variety originally described by Rondeletius.

Pompilus Bennettii.

Leirus Bennettii, nob. in Camb. Trans. VI. 1, 199, *t.* V.—Syn. Mad. Fish. p. 179.

Centrolophus ovalis, Cuv. et Val. IX. 346.

——— *crassus*. Ib. 348.

The genus *Leirus* proves identical with *Centrolophus*, Lac., which in its turn, if not intolerable in itself (see Cuv. and Val. IX. 331.), must yield precedence to the prior claims of *Pompilus*, Rond. The species described by the Ichthyologist of Montpellier, (*Centrolophus pompilus*, Auct.) ought, on the other hand, as long ago by Willughby, to be called *Pompilus Rondeletii.*

Brama Raii, Bl. "*Freira.*"—Syn. Mad. Fish. p. 179.

The true affinities of this fish are most assuredly Scombridal, or to speak more strictly, Coryphænidal.

It was in reconsidering those of *Brama*, and in reaching this conclusion, that I was first led to detect the true affinities and synonyms of *Leirus*. It was not till convinced of the necessity of placing *Brama* next to *Pompilus* (*Centrolophus*, Lac.), that I discovered *Leirus Bennettii* to be a genuine species of this last-named genus.

So valuable are these studies of affinities; and thus do even errors often lead to valuable truth. I was not wrong, however, in associating *Leirus Bennettii* with *Brama*; but in not referring sooner it, or rather both, to the neighbourhood of *Pompilus*.

Fam. Mugilidæ.

Mugil maderensis. "*Tainha de moda.*"

This is the fish published, in the former part of this list, under the name and with the synonyms of *M. Chelo*, Cuv. Comparing it, however, more closely with the description of *M. Chelo* in the eleventh volume of MM. Cuvier and Valenciennes' Histoire, I find the following principal discrepancies in the Maderan fish :—

1. The produced scaly appendages at the base of the first dorsal fin extend considerably beyond the base of the fourth spine.
2. The maxillary is but very slightly S-like.
3. The upper lip is by no means peculiarly thick and fleshy, but rather the contrary.
4. It is a shallower, less deep fish in proportion to its length.
5. The tongue is altogether smooth, without any " asperités " whatever, at the edges or anterior end of the " arête," which cannot be called " très-aigue."
6. The palate also is entirely smooth, not papillose near the vomer.
7. A conspicuous bright metallic brassy spot on the opercula, as in *M. auratus*, Cuv. and Val.

It differs, however, essentially from this last-named species, and from *M. breviceps*, Cuv. and Val., in the exposure of the ends of the maxillary.

Fam. Gobidæ.

Having considerably extended my list of species, as well as rectified some errors in the nomenclature of others, I subjoin a complete enumeration of the Maderan species of this family hitherto discovered.

Blennius gattorugine, Will. Cuv. et Val. XI. 200. Will. Ichth. 132. t. H. 2. f. 2.—Yarr. 1. 226. Rariss.

A single individual only has occurred.

Blennius palmicornis, Cuv. et Val. XI. 214. t. 320. Syn. Mad. Fish. 185. Vulgaris.

Blennius Artedii, Cuv. et Val. XI. 231. —— *inæqualis*, nob. Synops. Mad. Fish. 185. haud Cuv. et Val. Rarior.

This is the little fish, which, being formerly known to me only by a sketch, I had erroneously supposed to be referrible to *B. inequalis*, Cuv. and Val. On better acquaintance it however proves their *B. Artedii*; and is indeed a most distinct and well-marked little species, scarcely exceeding two inches in length, and at once characterized by its active lively habits, its light tawny brown or yellowish olive colour, sprinkled all over with numerous white specks or dots, and the hollow, triangle-shaped, ciliate, occipital crest.

Blennius parvicornis, Cuv. et Val. XI. 257. Syn. Mad. Fish. 185. Rariss.

Of this, as formerly of *B. Artedii*, I have no means of judging, except from some notes and a drawing taken by Miss Young, July 10th, 1835, during my absence from the island. My friend Mr. Yarrell has, however, examined the individual from which these were taken; and on his accuracy I rely entirely for the correctness of the above name or reference. I had before supposed it to be undescribed, calling it *B. strigatus*.

Pholis lævis, Flem. Cuv. et Val. XI. 269. Yarr. 1, 230. Syn. Mad. Fish. 185. Rarior.

I cannot help suspecting that MM. Cuvier and Valenciennes' Maderan specimen at least, discovered by my friend Henry Richardson, Esq., of Aber Hirnant, North Wales, of *Blennius trigloides*, Cuv. and Val. XI. 228, is really nothing but this state or variety of *Pholis lævis*, which differs from the ordinary European fish only in having five or six distinct dark blotches or "demi-bands" along the back. I have hitherto met with no other fish beside the present answering at all to their description of *B. trigloides*; whilst this state of *Pholis lævis*, although somewhat rare, is by no means so uncommon as to have been likely to escape Mr. Richardson's unwearied assiduity.

Salarias atlanticus, Cuv. et Val. XI. 321. Syn. Mad. Fish. 185. Vulgaris.

Tripterygion nasus, Riss. Cuv. et Val. XI. 409. Syn. Mad. Fish. 185. Rariss.

Gobius niger, β. nob.

————————, L. Syn. Mad. Fish. 185.

Gobius Maderensis, Cuv. et Val. XII. 55. Rarior.

I believe this to be a mere variety or state of the common European *G. niger*, Cuv. and Val., analogous to the above-mentioned Maderan state of *Pholis lævis*, Flem.

GOBIUS EPHIPPIATUS, *G. fuscus, maculatus et punctatus: capite nuchâque nudis, hac sulcatâ: pinnarum pectoralium dorsaliumque radiis haud productis: squamis magnis.*

D. 1ma. 6; D. 2da. 12; A. 11; P. 19; V. 5; C. $\frac{5\text{ v. }6}{5\text{ v. }6}+\text{XV}$; B. M. 5. Rariss.

Of a nearly uniform brown colour, a little paler on the belly, with a row of darker rich brown patches along the sides, and above these numerous scattered smaller spots. Head spotted. The spots on the head and fore part of the body are ocellate, or surrounded by a ferruginous or yellow ring. The eyes are scarcely a semidiameter apart. The ventral fins are united, but by a very low membrane in front. Length of the only individual which has hitherto occurred, five inches. It appears sufficiently distinct from all the described European species by its naked head and nape.

Fam. LOPHIDÆ.

CHEIRONECTES BICORNIS. *C. hispidus, setis furcatis, nudus, sexappendiculatus, pallide ruber, punctulis fuscis conspurcatus: fronte super oculos bicorni; cornu anteriore distincto, recurvo; posteriore gibboso-cristiformi; filamento intermedio inconspicuo: brachiis pectoralibus ventralibusque exsertis.*

D. 12; A. 7; P. 10; V. 5; C. $\frac{1+1}{1+1}+\text{V}$.

A single individual only has occurred of this pretty little species, which in the foregoing characters appears distinct enough from all enumerated by MM. Cuv. and Val.; approaching, perhaps, nearest to *Ch. furcipilis*, *pardalis*, or *coccineus*. It was only one and three-fourths of an inch long, and seven-eighths of an inch deep. The whole fish is strongly scabrous to the touch.

Fam. LABRIDÆ.

Crenilabrus caninus, nob. Synops. 186.

A most remarkable variety of this fish has the preopercle perfectly entire; invalidating thus completely the generic character. This state of the species appears permanent, and independent of age or size; whilst it is wholly unaccompanied by other marks of difference or indications of disease. It is rare comparatively with the normal form, but is described by MM. Cuv. and Val. under the name of *Labrus scrofa*.

ACANTHOLABRUS IMBRICATUS. *A. pinnâ dorsali analique basi squamosis; squamis subquaternis, bractearum modo imbricatis, inter spinas assurgentibus: dorsalis parte spinosâ postice unimaculatâ: caudâ utrinque bimaculatâ: squamis magnis.*

D. 20 + 9; A. 5 + 8; P. 15; V. 1 + 5; C. $\frac{3\text{ v. }4}{3\text{ v. }4}+\text{III}$; M. B. 5.

Crenilabrus luscus, nob. in Syn. Mad. Fish. 187; nec Yarrellii nec Linnæi.

This also proves distinct from Mr. Couch's Scale-rayed Wrasse (*Acantholabrus Couchii*, Cuv. and Val. 13. 248), to which, as figured by Yarrell for the *Labrus luscus*, L. (a true *Labrus*, according to Valenciennes), I had formerly referred it. A still nearer ally appears, however, to be *Acantholabrus Palloni*, Cuv. and Val. 13. 243 (*Crenilabrus exoletus*, Risso, haud *Labrus exoletus*, L.). From this it differs in the extension up between each of the spines of the dorsal and anal fins of generally four of the large scales into a curious distinct and moveable imbricated appendage; in the large dark spot or patch on the hinder end of the spiny portion of the dorsal fin; in having two dark spots on each side at the base of the caudal fin, one on the dorsal, and another fainter on the ventral line; and lastly in the general colour. In the first and last of these four points, it agrees better with *Acantholabrus Couchii*, Val. (*Crenilabrus luscus*, Yarr., Brit. Fish. 1. 300); but it differs in the other two, is only half the size, and whilst the dorsal and the anal fins have severally one spine less, the dorsal has one soft ray more.

Labrus reticulatus.

This fish cannot be at present safely referred to the Ballan Wrasse of British Authors (*Labrus maculatus*, Bl.), Yarr. 1. 275; although in size and form of body, no less than in the peculiar lowness of the spiny portion of the dorsal fin, and abrupt production of the soft part of the same, and of the anal fin, as well as in the number of the rays of all the fins, there is a strong agreement. It will, I think, however, ultimately prove merely a dark variety of that species. The colour is peculiarly sombre; being a dark brown, approaching on the back almost to black; the whole beautifully reticulated with dark chestnut-brown lines, forming a border to each scale, and leaving the centre pale. The preoperculum was scaly. A single individual occurred in March 1838, and measured sixteen inches in length. Its fin-formula was,

D. 19 + 11; A. 3 + 9; P. 14; V. 1 + 5; C. $\frac{3 + \overline{\mathrm{I} + \mathrm{VI.}}}{3 + \mathrm{I} + \mathrm{V.}}$; B. M. 5.

This individual has been deposited in the Society's collection.

Ctenolabrus iris, Cuv. et Val. XIII. 236. Rariss.

A most elegant and well-marked little species.

Julis unimaculata.—"*Peixe Verde.*"—*J. elliptico-oblonga, graciliuscula: corpore aurato-viridi, lateribus medio fasciâ longitudinali obscurâ: squamis magnis, liturâ rufâ perpendiculate notatis: capite rosaceo-rufo, strigis fasciisve flexuosis cæruleis picto: pinnâ dorsali medio unimaculatâ analique basi squamatis: operculo postice biangulato: caudâ lunatâ, locis abbreviatis.*

D. 8 + 13; A. 3 + 11; P. 2 + 13; V. 1 + 5; C. $\frac{2\mathrm{v.}\,3+\mathrm{VI.}}{2\mathrm{v.}\,3+\mathrm{VI.}}$

Var. *α. tæniata*: corpore 5–6-fasciato: fasciis angustis viridibus, immaculatis. Vulgatiss.

Var. *β. lineolata*: corpore efasciato, toto lituris rufis creberrimis ad perpendiculum ductis æqualiter picto. Vulg.

Blended apparently by Valenciennes (Hist. XIII. 377.) with the blue-collared *J. turcica*, Risso, under the name of *J. pavo*; as formerly by me considered merely a variety of *J. turcica*. Long-continued observations have, however, established its claim to rank as a species, which is composed of two varieties, precisely corresponding with the two of which the true *J. turcica* consists.

JULIS MELANURA. *J. oblongus, postice nigrescens: capite superne dorsoque olivaceo-fuscis: lateribus perpendiculate strigatis; strigis posterioribus nigricantibus: pinnæ dorsalis antice altioris radiis tribus primordialibus longioribus, operculique angulo lato truncato, basique primarum pectoralium cæruleo-nigrescente notatis: pinnâ dorsali analique fasciatis, basi nudis; caudali rotundato nigricante: squamis parvis: dente solitario majore ad canthum oris utrinque, antrorsum porrecto.*

D. 9 + 12; A. 3 + 12; P. 14 v. 15; V. 1 + 5; C. $\frac{4+\mathrm{VI.}}{4+\mathrm{VI.}}$; M. B. 6; Vert[æ]. 25.

Julis speciosa, nob. in Syn. Mad. Fish. 186; haud Rissoi.

———————, Cuv. et Val., Hist. 13. 375; quoad tantum exempla *Canariensia*, et forsan quidem *Maderensia*.

On re-examination and a close comparison of this fish with MM. Cuvier and Valenciennes' description of the true Mediterranean *J. speciosa*, of Risso, I find that it is properly distinct; although a Canarian individual at least of it has been referred by Valenciennes, as the Maderan fish was formerly by me, to Risso's species. It differs chiefly in the elevation of the three first rays of the dorsal fin, the spot on which is small, not large; in the deep blackness of the caudal fin and hinder part of the tail or body; and, lastly, in being of considerably larger size (8–10 inches in length) than the true Mediterranean *J. speciosa*, Riss. Not having met at present with any other fishes in Madeira which agree so nearly as *J. melanura*, with that species, I cannot help suspecting that in M. Valenciennes' Maderan specimens of his *J. speciosa* may exist the principal peculiarities which he has expressly noted in Mr. Webb's Canarian example, and which are precisely those of *Julis melanura*.

Fam. FISTULARIDÆ.

CENTRISCUS GRACILIS. *C. corpore gracili, angusto, elliptico-oblongo, supra fusco, lateribus argenteis: rostro producto, elongato: pinnæ primæ dorsalis, inter oculos pinnamque caudalem mediæ, spinâ secundâ mediocri, breviore, pinnam caudalem nequaquam attingente.*

1ma D. 4 v. 5; 2da D. 11; A. 17; V. 1 + 4; P. 15; C. $\frac{7 + \text{IV.}}{7 + \text{V.}}$ Rarior.

In its shape and colour this is very obviously different from the common red Snipe-fish (*C. Scolopax*, L.). But I have not been able to assure myself that the above differences are not sexual. They are certainly not dependent upon size. The depth averages from one-fifth to one-sixth and a half of the whole length, instead of one-fourth of the same. In two individuals of the same length within one quarter of an inch, the depth of the larger (*C. Scolopax*, L.) was very nearly double that of the smaller (*C. gracilis*, nob.), and the 2nd spine of the 1st dorsal fin was respectively in each one-fourth and one-seventh of the whole length of the fish.

Fam. Esocidæ.

Belone gracilis, nob.—" *Catuta.*"

Early in March last year (1838) a fisherman brought alive in sea-water two fishes, which, in their slenderness, and the upper jaw being only half the length of the lower, differed obviously from the common *B. vulgaris*. Measuring, however, seven or eight inches only in length, it seemed questionable, in the absence of equal-sized individuals of *B. vulgaris* for comparison, whether they might not be the young of that species. My friends, however, the Rev. L. Jenyns and Mr. Yarrell, have examined these two individuals, and the latter warrants me in stating, on their joint authority, that these two fishes are " not, in their opinion, *B. vulgaris*," being " much more slender for the same or equal length."

Scomberesox Saurus, Cuv.

The Portuguese name "*Delphine*" (rectius "*Delfim*,") is erroneously appended to this fish. Another individual has been lately brought to me with the name of "*Almeirão*," but the species is far too rare to have obtained any permanent and genuine appellation in Madeira.

Cypselurus pulchellus.

From want of materials for comparison, I am unable to give correctly the specific characters of this most elegant little Flying-fish, which is remarkably characterized by two or three bright rose-coloured horse-shoe-shaped marks on each side of the belly, one behind the other. The ventral fins are placed a little behind the middle of the body, not reckoning the caudal fin, and their tips reach to the base of the latter. The tips of the pectoral fins reach only to the end of the base of the dorsal fin, which is large, high, and produced. The anal fin is small and low, but a little produced backwards. The cirrate appendage to the lower jaw is like a leathern flap or apron, torn irregularly at the bottom into strips or thongs. I willingly abandon my own MS. name of *Cheilopogon* for this genus, distinguished from *Exocœtus* by the variously-appendaged lower jaw, in favour of the designation which I find this group of fishes has received from Mr. Swainson whilst this paper has been going through the press.

Fam. Salmonidæ.

Scopelus maderensis.

A small dark mulberry-coloured fish, which might easily be taken for the fry or young of *Pomatomus telescopus*, Risso. The dark vinous-coloured ground is concealed by very large deciduous platinum-like scales. The only individual which has yet occurred was three inches long. It approaches very near to *Sc. Humboldti*, Risso, Hist. iii. 467. (supposed to be identical with Pennant's *Argentine*, Yarr. 11. 94.), and has the row of larger silver dots, or pits, extending forwards from the root of the caudal fin along the ventral line: but it disagrees remarkably with the generic characters assigned to *Scopelus* by Cuvier, R. An. 2nd Ed. ii. 314, in having both the palatines and tongue aculeate with teeth.

The fin-formula in the Madeiran fish was

1st, D. 3 + 10; 2nd, D. 1 club- or feather-shaped;

A. 2 + 12; P. 13; V. 1 + 7; C. $\frac{7+\overline{\text{I}+\text{IX}}.}{6+\overline{\text{I}+\text{VIII}}.}$.

Gen. Alysia.

Corpus subelongatum, compressum; dorso postice ventreque spinoso-serratis. *Rostrum* brevissimum, ore rictuque magnis, hoc pone oculos diducto. *Dentes* minuti, tenues; in maxillâ inferiore, Vomere, et Palatinis scobinati. *Lingua* postice lateribus subaculeolata.

Squamæ magnæ, haud deciduæ, scabræ; squamis lineæ lateralis latissimis, maximis, scutellatis, s. per totam longitudinem loricato-imbricatis.

Pinnæ ventrales sub apice pinnarum pectoralium sitæ. *Dorsales* duæ; prima inter Ventrales et Analem posita; 2$^{\text{da}}$ ad finem analis, rudimentalis. *Pinna caudalis* minima, furcata.

Alysia loricata.

The spinoso-serrate ventral and hinder part of the dorsal lines, together with the peculiar scales of the lateral line, appear to forbid the blending of this interesting little fish with the Cuvierian genus *Aulopus*, as defined in the R. Anim., Ed. 2. ii. 315, though they have many characters in common. The Maderan fish is no less rare than elegant. It scarcely exceeds two inches in length. The back is a deep blue; the sides bright silvery or platinum; and a row of dead-silver dots or pits extends along the ventral line, as in the *Scopelus* above described. The fin-formula is

1st, D. 2 + 10; 2nd, D. rudimentary; A. 2 + 21 (+ 8 detached depressed points or spines); P. 15 or 16; V. 1 + 5; C. $\frac{4+\overline{\text{I}+\text{IX}}.}{3+\overline{\text{I}+\text{VIII}}.}$.

Merlucius ambiguus.—" *Morcégo do mar.*"

Having only obtained a single individual, I forbear attempting a specific character of this little Hake, which, in the production into a filament of the second ray of the ventral fins and grooved nape, resembles a *Motella*; wanting, on the other hand, the beards, and having no trace of any fin within the nuchal groove. From *Merlucius Maraldi*, Risso, Hist. iii. 220. it differs in the colouring; and though the upper jaw closes over the under, it scarcely can be called " longer." In Risso's fish the nape is grooved (*sillonnée*), but he says nothing of any peculiarity about the ventral fins.

The Maderan Hake, or " Pescada," *Merlucius vulgaris* of my Synopsis, p. 189, proves, upon better acquaintance, distinct from the common British Hake, *M. vulgaris*, Cuv., Yarr., &c. (*Gadus Merlucius*, L.). Instead of being even, the dorsal and anal fins are each produced at their hinder end into a rounded lobe; the jaws are nearly equal in length; the teeth are large and numerous; the scales small. I do not name it, for I believe it has already been called by Mr. Swainson *M. sinuatus*; and I am doubtful whether it may not also be the *M. esculentus* of Risso, iii. 220, though in his synonyms he has confounded it with the true Northern Hake. I believe it to be the fish imperfectly figured long ago by Salviana, p. 73, copied by Willughby, *t.* L. membr. 2. *n.* 1, which has usually been referred to also for the Northern Hake.

Fam. Gadidæ.

Macrourus atlanticus.—" *Praga*" or " *Lagartixa do mar.*"—*M. fusco-cinereus, dorso vinoso, gutturis umbilico pinnisque ventralibus atris: squamis areolato-scaberrimis, echinalatis, ecarinatis, inermibus: oculis maximis.*

M. rupestris, nob. in Synops. Mad. Fish. p. 190, nec Bl. nec Cuv. et omiss. syn. *Lepidoleprus cœlorhynchus*, Risso.

On further examination, this most singular fish appears to be quite distinct from *M. rupestris*, Bl. t. 177; and therefore, according to Cuvier (R. Anim. 2nd Ed. ii. 337, note), from *Lepidoleprus cœlorhynchus*, Risso, through which indeed alone I had referred it to the northern fish described by Bloch. But besides the points included in the specific character, the first ray of the first dorsal fin is neither serrate nor stronger than the rest. The diameter of the eye is one twelfth or one thirteenth part of the whole length, which scarcely exceeds one foot.

Fam. Pleuronectidæ.

Rhombus cristatus. *R. corpore oblongo-elliptico: oculis approximatis: dentibus tenuibus pectinatis; in maxillâ superiore uniseriatis; in inferiore anguste scobinatis: pinnæ dorsalis dimidii anterioris radiis apice liberis; primordialibus* (2do—6to.) *productis, elongatis: latere* (*sinistro*) *fusco, immaculato: squamis* (*haud deciduis*) *magnis, margine scabris.*

D. 92; A. 75; V. 6; P. 1 + 9; C. $\frac{3+\text{VI.}}{3+\text{V.}}$ Rariss.

The Whiff of British authors (*R. megastoma*, Yarr. 2. 251) appears the nearest ally of this apparently new species. Indeed, except for Mr. Yarrell's more detailed account, I should have scarcely perhaps scrupled referring it to "La Cardine ou Calimande" of Cuvier's R. Anim. 2. 341, of which he says, "ses premiers rayons sont libres;" of course meaning of the dorsal fin. Nothing is, however, discernible of this in either Mr. Yarrell's figure or description of "The Whiff;" nor even, if correct, does it express sufficiently the peculiarity of this part in the Maderan fish. The only individual which has yet occurred was five and a quarter inches long.

Fam. Cyclopteridæ.

Lepadogaster zebrinus.—"*Chupa sangue.*" *L. fusco-nigrescens, lateribus postice strigis obliquis, nuchâque fasciis divergentibus saturatioribus maculisque binis cæruleis pyriformibus pictis: naribus biciliatis: pinnis dorsalibus analibusque caudali adnatis.*

D. 17 v. 16; A. 10 v. 9; P. 15 v. 16; V^s^. 4; C$\frac{7}{6}$ + X. Haud rara.

In the double nasal cilia, and connexion of the caudal with the dorsal and anal fins, this little fish agrees with *L. cornubicus* (Flem.), Yarr. 2. 264. The structure of the sucking disk is also similar to the representation of the same part in that species, and not to that of the "*bimaculated Sucker*," at p. 268. In this particular it perfectly agrees also with the former species indicated in my Synopsis, p. 190; which is, however, perfectly distinct specifically, having neither a nasal cilium nor the caudal fin united with the dorsal and anal fins. Of this last-mentioned species no second example has yet occurred. The present (*L. zebrinus*) is not by any means uncommon. It varies considerably in intensity of colour, and in the distinctness of the darker stripes upon the nape and flanks. The nasal cilia are of the general dark brown or blackish tint.

Fam. Echeneidæ.

§. *Cauda lunata.*

Echeneis Remora, L. Syst. Ed. 12.—"*Pegador.*" *E. tota cinereo-fuliginosa, nigrescens: laminis disci* xvii. *v.* xviii.; *pinnis pectoralibus brevibus, ovatis, integris, apice rotundatis: linguâ lævi.*

D. 23; A. 23; P. 26; V. 1 + 5; C. $\frac{3\text{ v. }4+\text{VIII.}}{3\text{ v. }4+\text{VII.}}$; M. B. 9. Rarior.

Echeneis pallida. *E. tota pallide cinerea, fuligineo hinc et hinc subnebulata: laminis* xix.; *pinnis pectoralibus brevibus, latis, apice rotundatis, subtruncatis, tenuiter crenulatis: linguâ medio scobinatâ.*

D. 24; A. 22; P. 27; V. 1 + 5; C. $\frac{3\text{ v. }4+\text{VIII.}}{3\text{ v. }4+\text{VII.}}$; M. B. 9. Rariss.

§. Cauda integra, S. truncata.

ECHENEIS JACOBÆA.—*E. tota cinereo-fuliginosa, nigrescens: laminis* xix.*: pinnis pectoralibus brevibus, latis, pectinato-rotundatis, crenatis: ventre sulcato: linguâ scabrâ.*

D. 24; A. 24; P. 21; V. 1 + 5; C. $\frac{3 + \text{VII.}}{3 + \text{VIII.}}$; M. B. 8. Rariss.

ECHENEIS VITTATA.—*E. purpureo-nigrescens, pallido variegata, fasciâque nigrâ longitudinali laterali, antice utrinque albo marginata: pinnis pectoralibus ovatis, acutiusculis, integris; pinnæ dorsalis analisque antice caudalisque marginibus albis: laminis* xxiii.*: linguâ scabrâ: oculis magnis: corpore elongato, postice valde attenuato, gracili.*

D. 39; A. 39; P. 22; V. 1 + 5; C. $\frac{1 + \text{VIII.}}{1 + \text{VII.}}$. Rariss.

The nearest ally of this very distinct species appears to be *E. lunata*, Bancr. in Zool. Journ. V. 413. t. 18. But this, besides other differences, has a lunate tail.

ECHENEIS BRACHYPTERA. (Echeneis ——— ? Syn. p. 191.) *E. cinereo-fuliginosa, nigrescens; pinnis dorsalibus analibusque antice albo submarginatis: laminis* xvi.*: pinnis pectoralibus brevibus, latis, truncatis, integris: linguâ medio scobinatâ.*

D. 28; A. 24; P. 26; V. 1 + 5; C. $\frac{3\text{ v. }4 + \text{VII.}}{3\text{ v. }4 + \text{VII.}}$; M. B. 8.

This is the first of the two species indicated by me in the former part of this List or Synopsis. Of the second sort, there mentioned as having been seen by Miss Young, and which I have there doubtfully referred to *E. naucrates*, L., no fresh example has occurred. I should now be much inclined to consider it identical with *E. vittata*; but Miss Young affirms that it was "certainly plain-coloured."

Fam. MURÆNIDÆ.

Sphagebranchus serpens.

S. serpa, Risso, Hist. Nat. iii. 195. No. 81.

A single individual only has occurred, precisely answering to the description above referred to. It measured eleven inches in length. I could not detect the slightest rudiment of pectoral fins.

Fam. GYMNODONTIDÆ.

Diodon Hystrix, α. Linn.—*D. punctatus*, Cuv.—*Histrix piscis Clusii*, &c., Will. *t.* I. 5.

A single example only has occurred.

TETRODON CAPISTRATUS. *T. pusillus, oblongiusculus, lævissimus; dorso iliisque inermibus, nudis; ventre adpresso-spinelloso: dorso fusco; lateribus ochraceo-fulvis, fusco longitudinaliter bifasciatis, capiteque utrinque cæruleo punctatis, iliis oblique lituratis, rostroque subproducto gulâve semi-capistrato: pinnâ caudali utrinque nigro-limbatâ.*

D. 9; A. 8; P. 16; C. $\frac{2}{2\text{ v. }3}$ + VIII. Rariss.

A most elegantly-coloured little species, which I cannot refer with certainty to any already described. Only two individuals have hitherto occurred. The first was little more than two inches long: the second nearly twice as large.

The *Orthagoriscus* of Madeira, called by the fishermen, "*Peixe Porco*," or "Bouto," I forbear at present to designate further, not having seen a sufficient number of individuals to determine its characters. The caudal fin is produced into a short point in the middle, not truncate, as in all the figures to which I have access of the European Sun-fishes.

Fam. Squalidæ.

Carcharias falcipinnis. "*Faqueita.*" *C. corpore supra griseo-cinereo, subabbreviato, medio crassiore s. altiore, utrinque attenuato: rostro brevi, lato, depresso, apice obtuso: oculis rotundatis: pinnâ dorsali primâ altâ, triangulari, subanticâ s. supra medium pinnarum pectoralium positâ: pinnis pectoralibus falcatis, angustis, elongatis, apice obtusis: pinnâ dorsali secundâ analique oppositis: ventralibusque parvis.* Rariss.

An *Squalus ustus*, Dum.

It is perhaps only for want of better materials for comparison that I have been unable to refer this Shark precisely to the above-indicated or to some other described species. It is about three feet long, and the female differs in nothing from the male. The teeth are precisely similar to those of the "*Tintureira*" (*C. glaucus*, Cuv.).

The "*Marraxo*" proves to be, as I suspected, *Lamna cornubica*, Cuv., adult, or of large size.

Carcharias microps.—"*Tubarao.*"

The *Tubarao* of Madeira proves to be a genuine species of *Carcharias*, as defined by MM. Müller and Henle in the Magazine of Natural History for the year 1838, p. 35. It is remarkable for the smallness of the eye; and the teeth, as reported previously by the fishermen, are really feeble in proportion to its bulk; they are in only two rows, and precisely similar in both jaws. The tail is very large and powerful. The individual examined measured eight feet five or six inches in length. I name it only provisionally, and abstain again from attempting a specific character,—deferring, in both points, to the expected publication of MM. Müller and Henle, amongst whose indicated "twenty species" it will probably be found.

Alopecias superciliosus.

At once distinguished from the only other known species of the genus, *Carcharias vulpes*, Cuv., by the enormous eye and its prominent brow. I have at present only seen a single young example.

Gen. Acanthidium.

Corpus gracile, elongatum. *Spiracula* magna. *Pinnæ dorsales* duæ, antice spiniferæ;

secundâ majore posticâ, caudæ approximatâ. *Pinna analis* nulla. *Pinnæ ventrales* subposticæ s. secundæ dorsali subanteriores.

Dentes utriusque maxillæ dispares, parvi: superioris laniarii, plano-triangulares, tenues, acuminati; acumine recto; basi utrinque denticulo aucto; antice triseriati, lateribus biseriati: inferioris incisorii, acumine utrinque a medio oblique deflexo, uni- vel bi-seriati. *Cauda* oblique oblonga, apice truncata.

This new genus appears exactly intermediate between the established genera of Cuvier, *Spinax* and *Centrina*: agreeing with the former in its elongated form, and with the latter in the teeth.

The ventral fins are placed more backward than in *Spinax*, but rather forwarder than in *Centrina*, i. e. neither halfway between the two dorsal fins, nor opposite the second dorsal fin, but just before the second dorsal fin, which begins exactly opposite the termination of their base. The tail or caudal fin resembles that of *Spinax* rather than of *Centrina*, and the spines of *both* the dorsal fins are reflexed as in *Spinax*, forming the fore-edge of each fin. The pectoral fins are abruptly truncate. The second dorsal fin is greatly larger than the first; in which it differs equally from *Spinax* and *Centrina*. The teeth are not arranged quincuncially, but behind each other in rows.

Two species have occurred, both of which have hitherto been confounded with *Centrina*.

ACANTHIDIUM PUSILLUM. "*Gata negra.*" *A. totum atrum, pusillum: rostro crassiusculo: dentibus inferioribus uniseriatis: spiraculis oculo remotiusculis.*

Centrina? nigra, nob. olim in Proceed. Zool. Soc. 1833, p. 144*. Syn. Mad. Fish. in Trans. Zool. Soc. p. 194. Rariss.

Four individuals of this curious little shark have now occurred, agreeing equally in the foregoing characters and in their dimensions, varying in length only from eleven to twelve inches. The second dorsal fin is somewhat forwarder or more distant from the origin of the tail than in the next species.

The condition of the teeth, and constancy of size, both indicate an adult fish; and a comparison of the present species with the fœtal and adult state of the following, in these two points alone demonstrates *Acanthidium pusillum* to be no stage of *A. calceus*.

ACANTHIDIUM CALCEUS. "*Sapata.*" *A. purpureo-fuscum, subtus pallidius: rostro plano-depresso: dentibus inferioribus biseriatis: spiraculis oculo, pinnâque dorsali secundâ caudæ approximatis.*

Centrina Salviani, Syn. Mad. Fish. in Trans. Zool. Soc. p. 194: nec aliorum. Rarior.

* A serious erratum has been caused here by the transposition of a sentence. The paragraph referred to should stand thus: "It (*Centrina? nigra*) is intermediate in characters between *Centrina*, Cuv., and *Acanthias*, Risso, having the teeth of the former genus as well as the backward position of the second dorsal (*rectius* ventral) fin, and the form of body of the latter."

This shark very much resembles in its general aspect *Scymnus nicæensis*, Risso, the "*Gata*" of Madeira: but is at once distinguished by the spines in front of the two dorsal fins, which, as in *A. pusillum*, are both recurved, and ought, had I attended to the excellent figures copied by Willughby from Salviani of *Centrina nigra*, Cuv., instead of allowing myself to be deceived by a miserable figure of Lacepède's, alone to have preserved me from the blunder of referring to that species for the present shark, the usual size of which exceeds by a few inches only three feet.

Fam. Raiidæ.

Raia oxyrhynchus, Will., Ichth. p. 71.—"*Raia*."

Sharp-nosed Ray, Penn., Ed. 1. iii. 83. No. 31. Yarr., Brit. Fish. ii. 424.

Two male individuals only have occurred: the largest, measuring three feet in width from wing to wing, was furnished on the back with patches of strong hooked spines or prickles, much as in the figure in the British Fishes; but the second example, scarcely two feet wide, although decidedly a male, was devoid of these appendages. The colour of the upper surface was a pale, dull, yellowish or ashy-grey, obscurely mottled or dappled with a few scattered distant paler whitish spots.

Trygon altavela.—"*Andorinha do mar.*" *T. corpore rhomboideo, duplo latiore quam longo, alis expansis, caudâ perbrevi.*

Pastinaca marina altera *πτερυπλατεῖα*, Altavela Neapoli dicta *Columnæ*. Will., Hist. 65. Tab. C. 1. f. 3. (Copied from F. Columna.)—Rariss.

A single female individual only has occurred, measuring five feet and a half from tip to tip of wings.

II. *Notes on the birth of the* Giraffe *at the Zoological Society's Gardens, and description of the Fœtal Membranes and of some of the Natural and Morbid Appearances observed in the Dissection of the young animal. By* Richard Owen, *Esq., F.R.S., &c.*

Communicated June 25, 1839.

At the close of my paper on the Anatomy of the *Giraffe*[1], I alluded to the circumstance of connexion having taken place between the female *Giraffe* and one of the males in the gardens of the Zoological Society on the 18th of March, 1838, and again on the 1st of April, 1838. In the mode and brief duration of the *coitus*, the *Giraffe* most resembles the *Deer*. It is only at the period of the rut that the full-grown *Giraffe* has been heard to utter any vocal sound; the male at this time emits a short guttural bleat, like that of the *Stag*.

After the second *coitus* the female showed no further disposition to receive the male.

The pugnacious disposition of the males, though not so strongly excited at this period as in the *Deer* tribe, yet manifested itself in frequent assaults upon each other with the horns, which are wielded by a sidelong and backward swing of the neck; they have not been observed to kick or fight with their hoofs.

Many months elapsed before any change in the form or capacity of the *abdomen* of the female could be perceived, but at length an expansion of the lumbar region became manifest, and the movements of the *fœtus* could be felt through the abdominal *parietes*, especially of the left side, indicative of its position in the left horn of the *uterus*.

Notwithstanding these unequivocal symptoms of pregnancy, when more than a year had elapsed without a symptom of parturition, many began to doubt the fact, especially as the increased capacity of the *abdomen* was not so disproportionate as in the common Ruminants.

At the beginning of June 1839, however, a visible change took place in the external parts and capacity of the *vulva*; on the 10th of June the udder began to enlarge and the teats to swell. At length, after a gestation which had lasted 444 days, or 15 lunar months, 3 weeks and 3 days since the second *coitus*, parturition commenced at noon on the 19th of June, 1839. The fore-legs were first protruded, through the *chorion* and *vulva*, as far as the knees or carpal joints: after a lapse of five or six minutes the muzzle made its appearance, the head being bent over the left leg. The mother stood during the brief parturition, and seemed not to be weakened by her pains. The young animal when born was motionless: nearly a minute elapsed, when the first

[1] Zoological Transactions, vol. ii. p. 246.

spasmodic inspiration, accompanied by a general shudder, took place, and regular breathing followed. The inspirations were now forty-three in a minute, and attended with a marked expansion of the nostrils. Expiration was accompanied a few times by a low bleat like that of a *Fawn*. In half an hour the young *Giraffe* began to make efforts to rise, supporting itself on its fore-knees: in one hour it stood upright, on outstretched vacillating legs, and tried to totter towards the parent.

She, however, would not permit her offspring to come near her; the only indication of maternal instinct was an occasional lowering of the muzzle with a fixed gaze, as if trying to recognise the young intruder.

I took the following admeasurements of the young *Giraffe* a few minutes after its birth:

	Feet.	Inches.	Lines.
From the muzzle to the root of the tail, following the line of the back	6	10	0
——————— interspace of the horns	0	10	0
——————— termination of the mane at the base of the neck	3	2	0
Length of the back, from the mane to the root of the tail	3	8	0
Girth of the trunk	2	9	0
From the base of the *scapula* to the end of the fore-hoof	5	0	0
————— to *olecranon*	1	3	0
——— *olecranon* to the *carpus*, or fore-knee	1	10	0
——— *carpus* to the end of the hoof	1	11	0
——— anterior spine of the *ilium* to the end of the hind-hoof	4	7	0
——————————— to the *patella*	1	7	0
——— *patella* to the *calcaneum* or hock	1	4	0
——— hock to the end of the hoof	1	8	0
Length of each horn to the end of the terminal tuft of black hairs	0	3	0
Length of the ear	0	6	6
————— tail to the end of the terminal tuft	1	5	0

For the accompanying figures of the female *Giraffe*, and of her offspring when one day old, zoology is indebted to Robert Hills, Esq., F.L.S. This justly celebrated delineator of the Ruminant tribe, when made acquainted with the expected advent of a young *Giraffe*, kindly volunteered his services, and devoted much of his valuable time to secure a faithful representation of its peculiar proportions and external characters.

The characteristic markings and colour of the skin were as conspicuous in the newly-born *Giraffe* as is represented in the figure; the hoofs were, however, soft and tumid, as in new-born *Ungulates* generally. The *scopæ* or knee-tufts were not developed, but the brush of black hairs on the tip of the horns, and the terminal wavy hairs of the tail were present. The mane extended a little further upon the back than in the parent. The young animal was a male; the *testes* had descended into the *scrotum*, which was short and sessile.

The tufted horns were each supported by a moveable cartilaginous tubercle, the nucleus of the future bony core. The median frontal eminence was very slightly raised, and the hair covering this part was not longer than that of the surrounding skin.

The centre of the spiral radiation of the hair, situated at the middle of each flank, was more distinct than in the adult.

Ten hours after its birth the young *Giraffe* had acquired sufficient strength to walk, and at eighteen hours began occasionally to break into more rapid but somewhat uncertain and awkward paces.

The large size of the young *Giraffe* and the strength of its long and slender limbs, twenty-four hours after birth, were very striking. But when we reflect that its natural birth-place is infested by the *Lion* and other carnivorous animals, we may connect the long gestation of the *Giraffe*, and the consequent size and strength of its produce, with the necessity for its speedy ability to escape with the parent from these enemies.

The *meconium* was discharged in the course of the night after the birth, in the form of a hard round ball, weighing two ounces.

On the following day, as the mother still refused to allow her young one to suckle, or even to touch the udder, a cow was purchased that had calved a little more than a month, and the young *Giraffe* was fed on her milk warmed.

On the 21st the young *Giraffe* manifested perfect health and strength; he now galloped and gamboled about the house, and often teazed the mother by his attempts to reach her teats; but though she invariably repelled, or rather avoided these approaches, it was done without anger, and in all her movements she evinced a care not to hurt her young one.

From this time to the 28th of June the young *Giraffe* continued to exhibit increased strength, and a most attractive grace and playfulness in its active movements.

The alvine evacuations, which for the first two days had been more fluid than usual in young Ruminants, presented on the third day the appearance of hard and curdled milk, which was discharged in considerable quantity. After this the young animal was constipated for three or four days, and syrup of buckthorn with olive oil was administered; yet still its activity, its spirits and apparent health continued unabated until 6 o'clock in the morning of the 28th of June. The young *Giraffe* was now observed to stagger in its gait; the neck then began to be twisted about with a convulsive action; and every now and then he plunged violently forward.

Mr. Youatt being sent for, found the young *Giraffe* "scarcely able to stand; his neck was bent convulsively down to his shoulder and side. The spasm would then relax, and he would look around and recognise one and another of us, and come up to us and ask for food in his usual way. His countenance had much of its natural expression. The flanks were not much disturbed; but his muzzle was cold, and his legs were getting icy cold. I set four of the keepers to work to rub him, who brought back the warmth to his limbs, and in a great measure to his muzzle, and I gave him some warm boiled milk with opium, catechu, chalk and ginger in it. We sent into town for some good starch, and some of that was boiled in his milk, with more of the same medicine which he had just taken; but his strength gradually failed, and about half past 10 o'clock he died."—*Journal of the Medical Superintendent.*

At the *post-mortem* examination of the young *Giraffe* my attention was first directed to the state of the stomach and intestinal canal: the first three cavities were empty; the *rumen* was not loaded with curdled milk, as I have seen it in calves which have died young, and in which the milk has not passed, as it should do, directly into the fourth stomach. The only deviation from the natural state was the acid reaction of the mucus of the *rumen*, *reticulum*, and *psalterium* upon litmus paper, instead of the alkaline character which the secretions of these three cavities present, at least in full-grown Ruminants.

The acid reaction was more strongly marked in the fourth stomach. The coagula of milk in this cavity were evidently undergoing the natural process of solution: the digestive function seemed not to have been interrupted: the mucous membrane was red in several places from turgescence of the capillaries; but this might have arisen from the activity of the function being continued to near death, or from the action of the stimulating medicine last administered. The mucous coat readily separated from the submucous tissue; but this was probably due to the continued action of the gastric juice after death, and may be regarded as another proof that the healthy function of the stomach had not been deranged.

I could perceive no clear evidence that the disease, much less the death of the young animal, was owing to derangement of this part of its organization.

The mucous membrane of the small intestines presented increased vascularity as it approached the *colon*, and the lining membrane of the commencement of this gut was unduly congested; but the *cæcum* and termination of the *colon* and *rectum* presented no unusual traces of vascularity.

The other *viscera* of the *abdomen* and those of the chest were in a healthy state.

The membranes of the brain were unduly injected.

Considering these appearances, in connexion with the sudden access and symptoms of the fatal malady, I am disposed to attribute the death of the young *Giraffe* to disorder of the nervous system. The source of this disorder may have lain in the continued though slight derangement of the functions of the intestinal canal, which was probably caused by the unnatural food, which the indifference of the parent compelled the keeper to resort to. It is not improbable that the disaffection of the young mother to her offspring may have originated in the interference in the first instance with her peculiar functions. The maternal instincts of the brute may be compared to a complex machine, of which the first wheel being set in action, the other movements duly succeed each other, but otherwise are not brought into play. In the present instance, the separation of the *umbilicus* was not effected by the teeth of the parent, nor the removal of the saline moisture of the new-born animal by her tongue. Man stepped in with his uncalled-for aid, and the natural introduction of the mother to her offspring never took place. The result, however, could not have been anticipated; and had any untoward accident occurred, blame would have been more justly incurred, if the attention and assistance, which I am disposed to deprecate in a second instance, had not been so promptly rendered, as, to the credit of all parties concerned, was done in this first occurrence of the birth of a *Giraffe* in a European menagerie. With the confidence that the naturalist must have in the powers of the parent *Giraffe* to safely produce and render all proper aid to her own offspring, I should recommend, that in the event of a second gestation, the mother and her produce should be kept in a secluded place, without interruption or interference of any kind.

Of the Fœtal Membranes.

These were expelled about five hours after the birth of the *fœtus.*

The *chorion* formed a sac of considerable dimensions, as may be readily supposed from the large size of the young animal which it had included: a considerable portion of the *chorion* with the adherent vascular layer of the *allantois,* forming the so-called *endochorion,* was preserved and transmitted to me for examination. Numerous cotyledons were developed from the external surface of this portion of the *chorion*; the larger or regularly formed cotyledons were most of them arranged in longitudinal rows, corresponding with the disposition of the cotyledonal processes of the *uterus,* described in my previous paper; they presented an oval or reniform figure, and were attached to the *chorion* by a contracted base; they were composed of long, delicate, slightly branched *villi,* much finer than those of the cotyledons of the *chorion* of the *Cow,* and more resembling those of the *Deer*: the largest of these cotyledons measured four inches in the long diameter; their average size is shown in Plate II. Fig. 2; the longitudinal arrangement and contracted or subpedunculate base of attachment is accurately represented in a reduced view of a small part of the *chorion* in Plate II. Fig. 1. Besides the larger cotyledons, there were numerous smaller ones, of irregular form and unequal dimensions, developed from the external surface of the *chorion* in the interspace of the normal cotyledons: these smaller ones varied in diameter from two inches to two lines; their component *villi* were proportionally short, and, in the smallest ones, simple and unbranched; so that the parts of the *chorion* where these were thickly scattered, presented a structure approaching to that of the non-placentiferous *chorion* of the *Camel* and certain Pachyderms; the smooth portions of the *chorion* were more vascular than in the ordinary Ruminants.

With respect to the anatomical peculiarities of the young *Giraffe*, I shall at present merely notice the condition of the antlers, teeth and *larynx*. Each of the small antlers was supported by an obtuse process of very dense cartilage, about one inch in height and ten lines across the base; this was moveably connected with the *pericranium*. On making a vertical section through the cartilaginous base of one of the antlers and the adjacent surface of the *cranium* (as shown in Plate II. Fig. 4.), ossification was found to have commenced by several small independent centres near the periphery of the upper half of the cartilaginous tubercle (*a*, *a*). As the bony support of the antler of the *Giraffe* continues, for a long period after its ossification is completed, a distinct epiphysis of the *cranium*, its original development might have been expected to have differed, as the present dissection has proved it to do, from the mode of growth of the antlers of the *Deer*; the cartilage was supported exclusively by the frontal bone close to the coronal suture, over which its base is afterwards extended in the progress of growth.

With respect to the *larynx*, I found the *epiglottis* and arytænoid cartilages relatively longer than in the adult; the whole *larynx* presenting a pyramidal form, with the margins of the apex bent outwards and projecting above the soft palate into the posterior aperture of the nasal passage; the anterior part and sides of the apex of the *larynx* were formed by the *epiglottis*, the posterior part by the retroverted tips of the arytænoid cartilages; the whole being inclosed in a continuous duplicature of the mucous and epithelial membranes of the *larynx*. A fold or ridge of the lining membrane is continued from the lower margin of the soft palate to the back part of the *pharynx*; a fasciculus of fibres is continued from those of the soft palate with the middle constrictor of the *pharynx* into this ridge, immediately below the expanded apex of the *pharynx*, the use of which is obviously to grasp that part of the *larynx*, and to isolate it more completely from the part of the *pharynx* which communicates with the mouth: this modification of the constrictors of the *pharynx* and apex of the *larynx* with the tonsils are shown in Plate II. Fig. 5.

The state of the dentition when the young *Giraffe* died, nine days after its birth, was as follows: in the lower jaw the crowns of the median incisors were almost entirely protruded through the skin; the edge of the adjoining incisor on each side had just cut the gum; the other incisors were still concealed. The apices of the first, second, third, and the anterior pair of the fourth molars had pierced the gum on each side. In the upper jaw the apices of the first, second, and the anterior pair of the third molars had pierced the gum. All the teeth thus apparent in both jaws belonged of course to the first or deciduous series.

ADDITIONAL NOTE.

On the 12th of March, 1840, nearly nine months after the birth of the young *Giraffe* described in the foregoing communication, the mother took the male three times. She was then kept apart until the 26th of May, 1841, when, after a gestation of 431 days, or 15 lunar months and 11 days, she brought forth a male.

The advice which I had tendered after the former occasion was in this instance followed. The manger of the pregnant female, when her time approached, was inclosed. The parturition was observed by the keeper outside. The fore-legs first appeared, the head and body followed: the mother stooped down behind to deposit her burthen safely on the litter. The young animal received those attentions from the mother which, in the previous case, had been afforded by her keepers. The natural relations were thus commenced, and were established, about 12 hours after the birth, by the mother yielding her udder to her offspring, which sucked strongly.

The young *Giraffe* presented the same external characters and dimensions as his predecessor.

After three weeks he began to take vegetable food; and when four months old, fed chiefly upon it and ruminated regularly like the parent. Standing six feet high when one week old, he attained the height of seven feet at the end of three months, and now, when nearly nine months old, he reaches nine feet six inches, having grown three feet six inches during that short period.

Four weeks after birth the four middle incisors were conspicuous; and the crowns of the two anterior molars on each side of both jaws were extricated from the gum and in use. At two months, the third incisor in each ramus of the lower jaw was acquired. At four months the third and fourth molars were in place, and the external incisors had cut the gum; they are now risen to nearly their natural height and position. At the present time the young *Giraffe* has acquired all his first or temporary teeth.

The shedding of this series and the acquisition of the permanent dentition form a much longer process. The parent *Giraffe*, for example, at the period of the birth of her second fawn, was shedding her external bilobed milk-incisors, the successors to which have not yet acquired their natural position in the series of permanent incisors.

DESCRIPTION OF THE PLATES.

PLATE I.

The female *Giraffe* and her young one, as it appeared when one day old, showing its relative size to the parent.

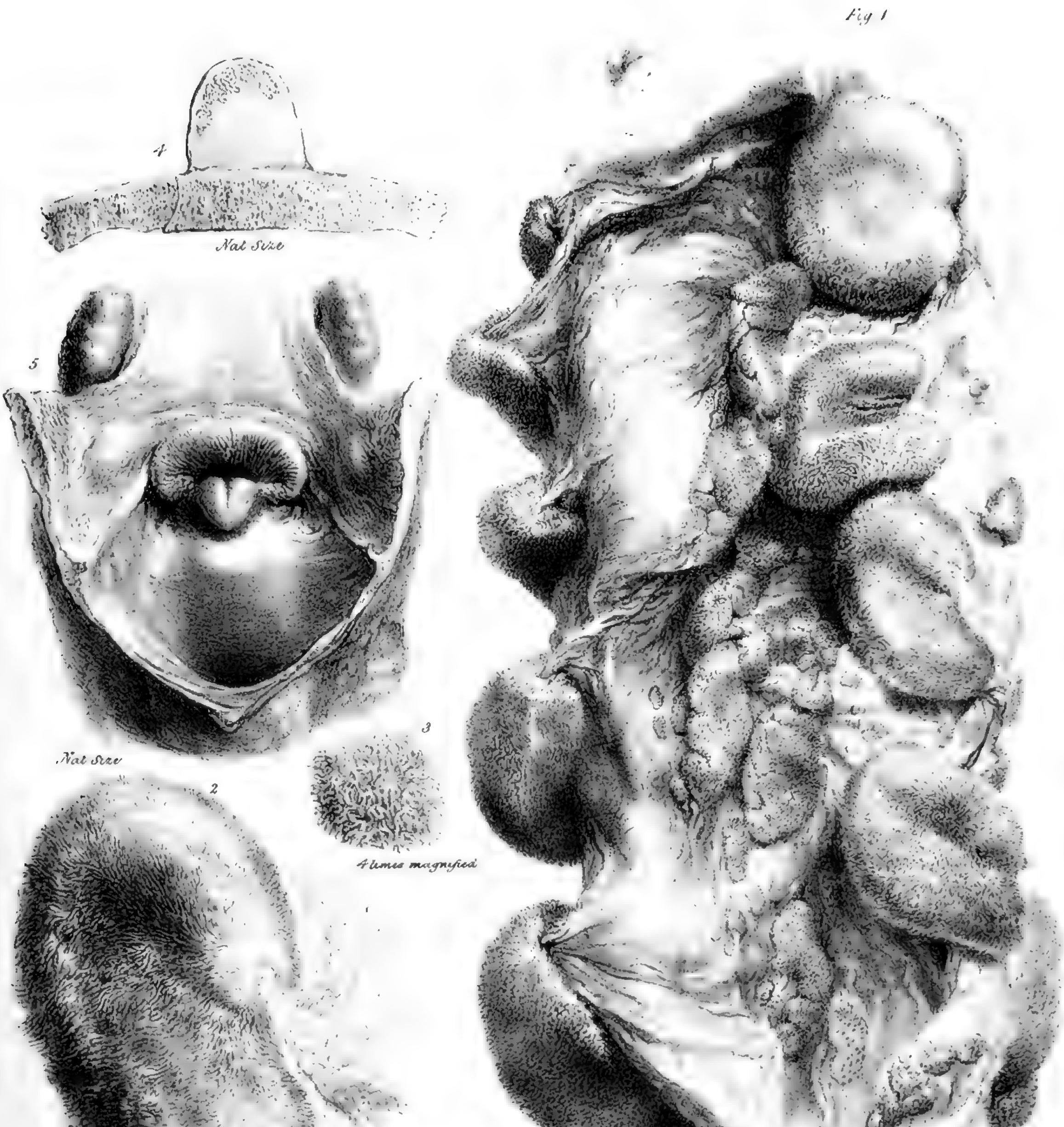
PLATE II.

Fig. 1. A portion of the *chorion* of the fœtal *Giraffe*, showing portions of two rows of the normal cotyledons and the intermediate irregular smaller ones: half the natural size.

2. One of the ordinary sized normal cotyledons, with a portion of the vascular *chorion* to which it is attached.

3. Component *villi* of the cotyledons, magnified four diameters.

4. The *pharynx*, and apex of the *larynx*, showing the relation of the *epiglottis* to the soft palate and nasal canal in the young *Giraffe*.



Camelopardalis Giraffa

III. *Notice of a Fragment of the Femur of a Gigantic Bird of New Zealand.* *By* Richard Owen, *Esq., F.R.S., F.Z.S., &c., &c.*

Read November 12th, 1839.

THE fragment of bone here described was placed in my hands for examination by Mr. Rule, with the statement that it was found in the island of New Zealand, where the natives have a tradition that it belonged to a bird of the *Eagle* kind, but which has become extinct, and to which they give the name of "Movie." Similar bones, it is said, are found buried in the banks of the rivers of New Zealand.

The fragment is the shaft of a *femur*, with both extremities broken off. The length of the fragment is six inches, and its smallest circumference five inches and a half. The exterior surface of the bone is not quite smooth, but is sculptured with very shallow reticulate indentations: it also presents some well-marked intermuscular ridges. One of these ridges (Pl. III. fig. 1) extends down the middle of the anterior surface of the shaft to about one-third from the lower end, where it bifurcates: two other ridges, or *lineæ asperæ*, traverse longitudinally the posterior or concave side of the shaft (Pl. III. fig. 2); that next the outer or fibular side of the bone is broad and rugged, the other is a mere linear rising.

The first and most obvious idea of the nature of this bone would probably be that it belonged to the human species, or to some of the larger domestic animals introduced into New Zealand by the settlers, for food or draught. It is, however, nearly double the circumference of the *femur* of an ordinary-sized man; it also differs in the greater expansion of the two extremities than would be presented by a section of the same length from any part of the shaft of a human *femur*, and by the interspace between the two longitudinal ridges at the posterior part of the bone; there being a single *linea aspera* in the corresponding part of the shaft of the human *femur*, where likewise the orifice of the ascending canal of the medullary artery is conspicuous.

From the *femur* of the *Ox* or *Buffalo*, the bone from New Zealand differs in its cylindrical form: in the *Ox* it is three-sided, and in the corresponding part of the shaft of the *femur* the *trochanter minor* would be included, of which there is no trace in the fossil; whilst, on the other hand, both the anterior and the two posterior longitudinal ridges are absent in the *femur* of the *Ox*: the difference between the bone from New Zealand and the shaft of the *humerus* of an *Ox* is still more striking.

A portion of the shaft of the *femur* of a *Horse* or *Ass*, corresponding in length with that of the bone here described, would have exhibited a portion of the small *trochanter*, as well as nearly the whole of the external or third *trochanter*, and of the deep and rough depression below this *trochanter*. The orifice of the medullary artery is as conspicuous in the *femur* of the *Horse* as in that of the *Ox*, on the outer and posterior part of the middle of the shaft.

The shaft of the *femur* in the *Hog* approaches more nearly in form to that of the fossil than the bones with which it has just been compared, but no species of *Sus* is now known to exist which presents a *femur* of equal size. The exterior *linea aspera* is formed by a sharp angle which divides the outer from the posterior surface of the bone, both of which surfaces are nearly flat in the *Hog's femur*; the corresponding ridge, besides being less sharply developed than in the fossil, is situated more on the posterior side of the bone; the anterior bifurcating ridge is wanting in the *femur* of the *Hog*.

If the bone from New Zealand be compared with the *femora* of the *Camel* or *Llama*, as great differences present themselves as in the human *femur*; the single *linea aspera* on the middle of the posterior surface of the bone, and the perforation of the medullary artery upon or near that ridge, forbid an approximation of these large Ruminants with the fossil.

The *femur* of the *Kangaroo* is at once distinguished by the longitudinal tuberosity developed on the middle of the posterior part of the shaft.

The *femur* of the *Dog*, independently of its inferiority in size in the largest specimens of this quadruped, differs from the fossil in the absence of the anterior ridge, and in the presence of the medullary canal near the middle of the posterior part of the shaft.

In order that no reasonable ground might remain for doubting the accuracy of the conclusion to which I have arrived in regard to the above-described bone, I have compared it with the long bones of other Mammalia approaching it in size, notwithstanding the improbability of their ever having found their way to the island of New Zealand. A section of the shaft of a *femur* of the *Grisly Bear*, and of other large species of *Ursus* corresponding in length and thickness with the fossil, does not give the expansion of both extremities, and is moreover flatter antero-posteriorly: the same difference is presented by the *femur* of the *Lion* and of other large species of *Felis*. The *femora* of both the two last-cited genera of Mammalia are characterized by the aperture of the medullary artery at the middle of the posterior part of the shaft. The *femur* of the *Ouran outang* differs as much as any of the preceding Mammalia from the fossil.

The differences between the fossil and the *humeri* and other long bones of the Mammalia above cited, are equally or more marked than in the *femora*.

The texture of the bone, which affords the chief evidence of its ornithic character, presents an extremely dense exterior crust varying from one to two lines in thickness: this then rapidly degenerates into a lamello-cellular structure of from two to three lines in thickness. The lamellæ rise vertically to the internal surface of the dense wall, are directed obliquely to the axis of the bone, decussate, and intercept spaces which are generally of a rhomboidal form, and from two to three lines in diameter. This coarse cancellated structure is continued through the whole longitudinal extent of the fragment, and immediately bounds the medullary cavity of the bone, which is about one inch in diameter at the middle, and slightly expands towards the extremities. There is no bone of similar size which presents a cancellous texture so closely resembling that of the present bone as does the *femur* of the *Ostrich*; but this structure is interrupted in the *Ostrich* at the middle of the shaft, where the parietes of the medullary, or rather air-cavity, are smooth and unbroken. From this difference I conclude our extinct bird to have been a heavier and more sluggish species than the *Ostrich*; its *femur*, and probably its whole leg, was shorter and thicker. In no other *femur* resembling or approaching in form and size that of which the shaft is here described, have I found superficial reticulate impressions like those above described, except in that of the *Ostrich*. The *Ostrich's femur* is subcompressed, while the present fragment is cylindrical, approaching in this respect nearer to the *femur* of the *Emeu*: but its diameter is one-third greater than that of the largest *Emeu's femur* with which I have compared it. The bones of the extremities of the great *Testudo Elephantopus* are solid throughout; those of the *Crocodile* have no cancellous structure like the present bone. The cancellous texture of mammiferous bones, again, is of a much finer and more fibrous character than in the fossil.

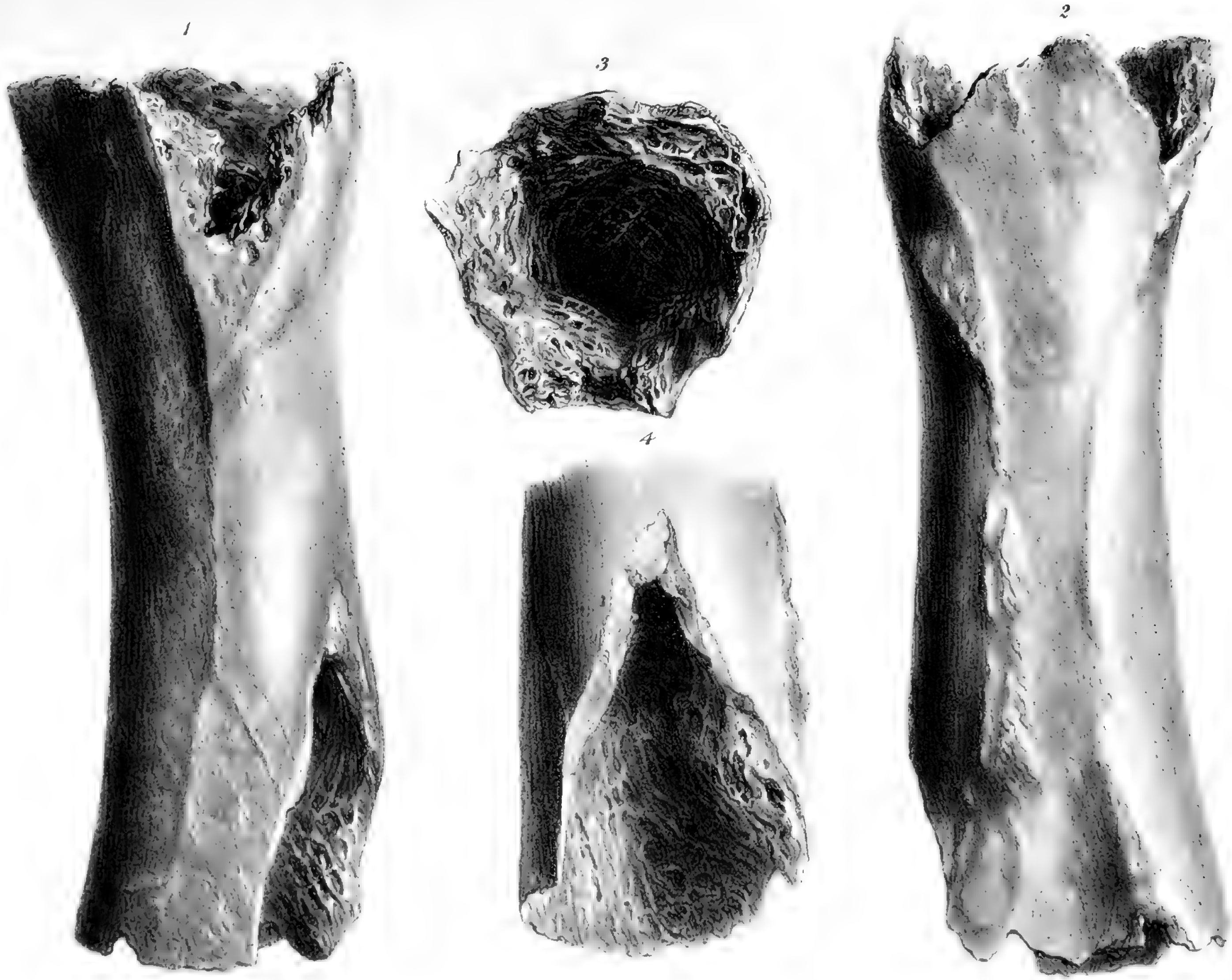
Although I speak of the bone under this term, it must be observed that it does not present the characters of a true fossil, being by no means completely mineralized: it has probably been on or in the ground for some time, but still retains much of its animal matter.

The discovery of the relic of a large Struthious bird in New Zealand is one of peculiar interest, on account of the remarkable character of the existing fauna of that island, which still includes one of the most extraordinary and anomalous genera of the Struthious order, and because of the close analogy which the event indicated by the present relic offers to the extinction of the *Dodo* of the islands of the Mauritius and Roderigue. So far as a judgement can be formed from a single fragment, it seems probable that the bird to which the above-described bone belonged, presented proportions more nearly resembling those of the *Dodo* than of any of the existing *Struthionidæ*. In the partially explored state of the islands of New Zealand it would be premature to pronounce the large Struthious bird thus indicated to be extinct. The present notice, it is hoped, may tend to accelerate its discovery, if it be still in being, or may stimulate to the collection of the remaining parts of the skeleton, if the species no longer exists.

DESCRIPTION OF THE PLATE.

PLATE III.

Fig. 1. Anterior view of the fragment.
2. Posterior ditto.
3. Internal view of its cancellous structure.



Femur of a Bird, from New Zealand

IV. *Monograph of the* Hollow-horned Ruminants. *By* William Ogilby, *Esq., M.A., F.R.A.S., F.G.S., F.L.S., &c., Honorary Member of the Royal Zoological Society of Ireland, and of the Société Zoologique* Natura Artis Magistra *of Amsterdam*; Secretary of the Zoological Society of London.—Part I.

Communicated January 14, 1840.

"Si, in redigendis auctorum erroribus hic nimis forte durus fuisse videar, cogitet Lector, nullibi magis vitiosos esse methodicos nostros recentiores, quam in recensendis Antiloparum speciebus, inque disponendis auctorum, maxime antiquiorum, eo spectantibus synonymis."—Pallas.

I. *Introductory Observations.*

In reviewing the history of the *Ruminantia*, the zoologist, who, like myself, has made a special study of these animals, must be forcibly struck with the confusion of synonyms, the carelessness and inaccuracy of description, the vague and indefinite limits of the generic and subgeneric groups, the trivial and confessedly empirical principles of classification, and, as a natural consequence, the great number of nominal species and the general disorder which still prevail in this department of mammalogy. The most recent writers on this subject are in no respect more correct or philosophical than their predecessors, and the motto prefixed to this memoir is as applicable at the present day as it was in the time of Pallas.

Yet it is not a little surprising, especially when we consider the great improvements which have been introduced into other departments of mammalogy since the commencement of the nineteenth century, that the generic distribution of the Ruminants, in many respects the most important order of the whole class, should remain to the present hour very nearly in the same state in which Ray left it one hundred and fifty years ago. Of course I speak only of the development of the natural relations and of the principles of classification applicable to the *Ruminantia*; the mere augmentation of species has been as great and as rapid in this as in any other group of Mammals; but in spite of the superabundance of materials—in spite of the pre-eminent interest which attaches to the animals themselves, from the symmetry of their forms, the gracefulness of their movements, their inoffensive habits and unrivalled importance in the œconomy of human life, and in the progressive development of civilization,—it is an acknowledged fact, that the generic divisions of the Hollow-horned Ruminants are more arbitrary and artificial than those of any other group of equal extent; and that this is perhaps the only department of mammalogy which the reforming hand of inductive science has hitherto left untouched. Various attempts have been made, it is true, to correct an evil of which all saw the magnitude, and to raise this branch of zoology to an equality with the more advanced state of the science in general; but these partial reforms, proceeding, as they invariably did, upon narrow and confined views, and without duly appreciating the relative value of the characters which they employed, produced no permanent improvement, and only served to emblazon the defects they were meant to erase; so that, however extraordinary it may seem, it is nevertheless indisputable, that there is at the present moment no natural group of Mammals of which the true scientific characters—those namely which definitely circumscribe natural genera, and influence the habits and œconomy of individual species—are so imperfectly developed and so little understood by zoologists in general, as are those of the *Ox*, the *Sheep*, the *Goat*, and the *Antelope*. The characters hitherto employed for that purpose, and adopted even by the most judicious and distinguished mammalogists of the present day, such as the form and direction of the horns, the solid or cancellated structure of the bony core which supports them, the presence or absence of a beard on the chin, or a dewlap on the throat, the comparative elevation or depression of the croup and withers, and similar trivial and artificial distinctions, are a disgrace to a science which claims to be considered as a branch of philosophy, and which really treats of principles and relations of consequence sufficient to establish its right to that distinction.

But it may be asked,—do such natural and influential characters really exist among the *Ruminantia*? Do these animals possess peculiarities of organic structure sufficiently prominent and important to point out the boundaries of their natural subdivisions, to influence their habits and œconomy, and to afford appropriate, exclusive, and obvious marks of generic distinction? And if so, how comes it that they have been so long neglected, or that naturalists have hitherto failed to appreciate their due weight and value? To answer these questions properly, as well as to understand the origin and extent of the confusion which prevails in this group, the arbitrary and artificial nature of its generic subdivisions, and the true scientific value of the characters which I propose to substitute, it will be necessary to take a short retrospect of the history of this part of zoology, and to mark the progressive advances which have been made, by the accumulation of new species, towards a more extended and accurate knowledge of the natural relations and characters of the Hollow-horned Ruminants.

II. *Historical Retrospect of the Classification of the* Ruminantia.

The history of classification in this, as in other departments of zoology, commences with the publication of the 'Synopsis Methodica' of Ray (1693), in which the principles of inductive philosophy were for the first time applied to this branch of knowledge, and a sound and rational logic employed to methodize and generalize the detached truths and observations buried in the chaos of facts, fictions and opinions which form the voluminous compilations of Gesner and Aldrovandus. His great object in the 'Synopsis Methodica,' to use the words of the illustrious author himself, was, "ut animalia omnia, certò cognita, methodo accuratiore, eorumque naturis magis consentaneâ quam quâ hactenus tradita sunt, disponeret[1];" and whoever studies the work, and makes proper allowance for the scantiness and imperfection of the materials out of which it was composed, must admit that he has admirably succeeded in the attempt. The generic distribution of the hollow-horned Ruminants in particular, is wonderfully correct in fact, however defective it may be in principle; nor should we be surprised at Ray's failure in this higher and more refined object of systematic arrangement, when we remember that succeeding zoologists have been equally unsuccessful in seizing the really influential characters of these animals, and classifying their true philosophical relations.

In fact, the whole number of species of hollow-horned Ruminants described in the 'Synopsis Methodica' does not exceed fifteen; and of these, besides the common domestic varieties, Ray appears to have known but four or five from personal observation. Of these, two only, the *Chamois* and the *Gemsbok*, belong to the modern genus *Antilope*, and they do not differ materially from the more common caprine forms; so that the *Ox*, the *Sheep*, and the *Goat* presented so many types of natural genera, to one or other of which all the hollow-horned Ruminants then positively known were easily referred, without any great violation of their natural affinities. The genera *Bovinum*, *Ovinum*, and *Caprinum*, established by Ray, are therefore strictly natural groups, and, abstracting the few anomalous species associated with the latter, but which subsequent observation has shown to possess different characters, can never be regarded in any other light. The imperfection of the arrangement lies, not in the result itself, but in the mode of arriving at it: the groups are perfectly natural, but the characters by which they are distinguished, and which are derived from the comparative size of the body, the smoothness, rugosity and curvature of the horns, the existence of a beard or dewlap, the number of teats, and the woolly or hairy nature of the covering, are as trivial, arbitrary and uninfluential as can well be imagined. Yet, considering the scanty nature of the materials at his disposal, one is more inclined to admire the accuracy and acuteness of the author's genius, than to condemn his partial and imperfect development of generic characters[2].

Forty-two years after the publication of the 'Synopsis Methodica,' appeared the 'Systema Naturæ' of Linnæus (1735), a work destined to revolutionize every department of natural science. Throughout the successive editions of this celebrated treatise, which contain enumerations of the *Mammalia*, from the second to the twelfth inclusive,

[1] Synop. Method. (preface).

[2] Ray has distinctly described six species of *Antelopes*; viz. those now called *A. rupicapra, addax, oryx, dorcas, grimmia* or *mergens*, and *bubalus*.

various improvements were at different times introduced into the generic distribution of the *Ruminantia*, as it had been originally sketched out by Ray. The *Camels* were associated with the rest of the order in the second edition (1740), and the genus *Moschus* was added in the sixth (1748); simple, concise, and logical definitions were given of all the genera, but they were still founded upon trivial and artificial characters, and the enumeration of species differed but little from that of the 'Synopsis Methodica.'

With regard to the *hollow-horned Ruminants* in particular, the generic definitions of Linnæus, however arbitrary and empirical, possess all the logical correctness and simplicity which so peculiarly characterized the genius of that great man, and which, as they originally gave weight and currency to his system, still form one of the chief bulwarks of his reputation. Throughout all the editions of the 'Systema Naturæ' published in his own lifetime, he retains the genera *Bovinum*, *Ovinum*, and *Caprinum* of his predecessor, without any further alteration than the simplification of the characters already alluded to, and a few occasional differences in the enumeration of species. The generic characters then finally settled were as follow:—

Bos: cornua concava, antrorsum versa, lunata, lævia;

Ovis: cornua concava, retrorsum versa, intorta, rugosa;

Capra: cornua concava, sursum versa, erecta, compressa, scabra;

and these definitions, arbitrary and empirical as they are, still continue, with scarcely any modification, to be the only really distinctive designations of the genera in question.

As to the characters themselves, it is evident that they are purely artificial; still the observation formerly made on the distribution of Ray may be applied with equal justice to that of Linnæus; though neither natural nor scientific, it was at all events exclusive and diagnostic, in reference to the small number of Ruminants then known; for Linnæus, like Ray, was acquainted only with fifteen species of hollow-horned Ruminants, even at the date of the twelfth edition of his work, and of these he does not appear to have personally examined a greater number than his predecessor. In his own time, therefore, the definitions of Linnæus were sufficiently appropriate and exclusive, though founded upon accidental and variable characters; had he possessed the ample means of observation afforded by the subsequent accumulation of species, he was too acute a logician, and too good a philosopher, to have rested satisfied with generic characters at once so vague, so trivial, and so uninfluential[1].

But whilst the zoology of the *Ruminantia* remained thus almost stationary in the hands of Linnæus, it was making rapid and brilliant progress under the auspices of his great rival

[1] The species of *Antelopes* described in the 12th edition of the 'Systema Naturæ,' amount to five only; viz. *A. rupicapra*, *gazella* (the modern *oryx*), *cervicapra* (now *addax*), *dorcas* and *tatarica* (now *saïga*); so that he has rejected two species, *mergens* and *bubalus*, from the list of Ray, and added one, *A. saïga*. It is almost superfluous to observe, that the term *Antilope* was then unknown, as a generic designation, and that both Ray and Linnæus include all these animals in the genus *Capra*.

and contemporary Buffon. Even so early as the year 1764, two years before the publication of the twelfth edition of the 'Systema Naturæ,' the last superintended by Linnæus himself, the French philosopher had, in the twelfth volume of his 'Histoire Naturelle,' described new forms and indicated important relations among the hollow-horned Ruminants, of which it is presumed that the personal rivalry known to exist between these two great men alone prevented the illustrious Swede from availing himself. I have elsewhere had occasion to express my belief that this unfortunate rivalry, and the mutual contempt which either party affected to entertain for the labours and opinions of his adversary, were, in all probability, the original cause of Buffon's antipathy to systematic arrangement in general, and the only impediment which prevented that eminent naturalist from giving us a more philosophical classification of Mammals than *has ever yet been published.* Tacit admissions of the scientific value of classification—and the little he has done in this line is invariably characterized by the elegance and penetration of his genius—break out in various parts of the 'Histoire Naturelle,' more especially where he has an opportunity of correcting or supplying the deficiencies of Linnæus, as, for instance, in the case of the American *Monkeys,* and of the group at present under consideration. But however this may be, Buffon's article on the *Gazelles,* contained in the twelfth volume of his great work, was the most important addition that had been made to the generic distribution of the Ruminants, as well as to the list of species, since the time of Ray, and must be considered as the first monograph of the genus two years afterwards founded upon it, and more formally proposed by Pallas, under the name of *Antilope.* Exclusive of nine distinct species enumerated under the generic head, nine others were here described in detached articles; so that at this early period Buffon was more or less perfectly acquainted with no fewer than eighteen species of Ruminants afterwards associated in the genus *Antilope*; whilst he has the singular merit of having introduced only two nominal species, and one other of a different genus into his list. The singular copiousness of Buffon's list, though published two years before it, forms a strong contrast to the meagre poverty of Linnæus's, and furnishes a remarkable instance of the antipathy which this great man bore to his equally great contemporary, since he would not even condescend to benefit by his labours[1].

The memoir of Pallas, which may be accounted the second monograph of the genus, was in a great measure a compilation from that of Buffon, but executed with all the judgment and discrimination which distinguish that author, and enriched with numerous original observations, and a careful revision of synonyms. It was first published in 1766, in the 'Miscellanea,' republished the year following in the first Number of the

[1] The species described by Buffon are *A. dorcas, kevella, gutturosa, koba, kob, algazel* (confounded with *oryx*), *dama, cervicapra, addax, rupicapra, saïga, bubalus, strepsiceros, scripta, grimmia* (not *mergens*), *pygmæa, redunca,* and *oreas*: and though the last nine are described in separate articles, they are expressly recognized as related to the *Gazelles,* under which generic title are embraced the first nine species; so that Buffon must be considered as the actual founder of the genus, though his name gave way to that afterwards proposed by Pallas.

'Spicilegia Zoologica,' and ten years afterwards in an improved and enlarged form in the 12th Number of the same work. Three new species[1] were added to the list of Buffon in the first of these memoirs, and a fourth[2] in the last; but, on the other hand, five[3] were originally rejected as nominal and three[4] afterwards, all of which have been subsequently verified and re-admitted. The original paper contains only one nominal species[5] which was rejected in the re-publication and final memoir; but the latter contains three other nominal species[6], and though more correct in the synonyms, throw little additional light on the group. In fact, it contains only the same number of species which Buffon knew thirteen years before. Upon the whole, from sixteen to twenty species of hollow-horned Ruminants were now recognized as generically distinct from *Bos*, *Ovis* and *Capra*, and the propriety of the separation proposed by Pallas was so obvious and so necessary, that the new genus was quickly adopted by contemporary zoologists, and still continues to maintain its place in the system.

The radical defect of the labours of Pallas in this department, consists in the vague, arbitrary and variable characters which he selected for the definition of the new genus, or rather to distinguish it from the genus *Capra*, for he has given no positive definition of the group itself. Had he allowed their due weight to the characters of the lachrymal sinus and the sexual nature of the horns, which he points out as distinguishing some species of his new genus, and applied the resulting principles, not to the *Antelopes* alone, but to the whole of the hollow-horned Ruminants, he would have arrived at a more simple and natural classification; but the authority of Linnæus was at that time so firmly established, and the veneration in which all his opinions were held was so great, that it would have been considered a kind of high treason to have proposed the adoption of any principles not admitted by him, or altered any of the definitions which he had established. The new genus of Pallas was accordingly constructed on the same model as the old genera *Bos*, *Ovis*, and *Capra*; yet already, even at the period of its formation, the author himself was so sensible of the practical inconvenience attending the loose and vague nature of its characters, that he was obliged to divide it into subordinate groups, according to the form of the horns, whether simply curved, lyrated, straight, twisted, or spiral. By this means an apparent individuality and precision were given to the subgenera, which in a great measure concealed the defects of the principal group itself, and by its speciousness imposed upon succeeding naturalists, as it materially retarded the progress of the science and the development of natural principles. The seeds of disorder thus early sown germinated rapidly, by the accumulation of new species, in the hands of Pennant, Allaman, Gmelin, Erxleben, Shaw, and other authors; every hollow-horned Ruminant which possessed neither the normal characters of an *ox*, a *sheep*, or a *goat*, as they had been settled by Linnæus, was, as a matter of course, as-

[1] *Leucophæa, picta,* and *pygarga.* [2] *Oryx.* [3] *Gutturosa, koba, kob, addax,* and *pygmæa.*
[4] *Koba, kob,* and *addax.* [5] *Corinna.* [6] *Lervia, tragocamelus,* and *leucoryx.*

sociated with the *Antelopes*, till this group became involved in almost inextricable confusion and inconsistency, and finally ceased to possess a single character, however trifling or unimportant, either exclusively appropriate to the genus, or even common to the generality of its component species.

These inconsistencies, and the insufficiency of the generic characters which gave rise to them, were too palpable to escape the notice of either the practical or theoretical zoologist. Various attempts were accordingly made to discover a remedy. For a long time, as has been already observed, these were confined to the subdivisions of the genus *Antilope* into subordinate groups, according to the form and curvature of the horns, as originally indicated by Pallas, a method which served tolerably well for the facilities of study and description, but which was obviously destitute of any pretence to scientific principle. The rise of the French school of zoology, however, towards the close of the last century, by overthrowing the scientific despotism of Linnæus, gave a new impulse to this as to every other department of Natural History, and zoologists soon began to perceive the necessity of searching for more permanent, exclusive, and essential characters. The illustrious Illiger, in his 'Prodromus Systematis Mammalium et Avium,' published in 1811, took the lead in this reform, by introducing for the first time into the characters of the genera *Bos*, *Capra*, and *Antilope*, the consideration of the muzzle and lachrymal sinus; and his principles were quickly adopted and applied, in successive monographs, to subdivide the latter genus into something more nearly approaching natural groups than the old principle admitted, by Lichtenstein, De Blainville and Hamilton Smith. The publication of Illiger's 'Prodromus' may be considered, therefore, as an epoch in the history of these animals, since it undoubtedly led to a partial substitution of natural characters for the purely empirical and arbitrary diagnoses formerly employed to distinguish the subordinate groups of the genus *Antilope*, and thereby promoted not only the recognition of specific differences, but, in a very considerable degree, the study of natural relations.

The monograph of Dr. Lichtenstein[1], published in 1812, contains descriptions of twenty-nine species, exclusive of the *Grysbok* and *Orabie*, which he considers to be only varieties of the *Steenbok*. The whole are distributed into four groups, characterized by the presence or absence of horns in the females, and of lachrymal sinuses, the existence or non-existence of a dewlap, and the comparative length of the tail; but the author was in many cases ignorant of the characters of particular species, and the composition of his groups is consequently faulty in proportion. The divisions, however, are exceedingly well imagined, and less encumbered with trivial characters than those of De Blainville and Hamilton Smith: had Dr. Lichtenstein been more correctly acquainted with specific characters, and availed himself of the form of the muzzle, already employed by Illiger, his distribution of the hollow-horned Ruminants would have probably required little improvement at the hands of his successors.

M. de Blainville, whose monograph of the genus *Antilope* was published in 1816,

[1] Magazin der Gesellschaft Naturforschender Freunde zu Berlin VI^{ter} Jahrgang.

appears to have proceeded by a different route from that of Dr. Lichtenstein, though he has adopted the same principles of classification. Instead of making the composition of his groups depend upon some preconceived essential characters, as appears to have been the plan of the German naturalist, he has followed an inverse method, and contented himself with separating from the main group successive detachments of what he conceives to be the most anomalous species, afterwards elaborating the characters of the subgenera thus formed from those of their component species. By this means he has unquestionably succeeded in forming a few natural groups, to which no other objection can be made than that they are considered as subdivisions of a primary group, which is not itself a natural genus; but, generally speaking, they are neither sufficiently comprehensive nor definitely distinguished from one another, and, as a necessary consequence of the plan pursued, the residual group, or that which remains after the separation of the abnormal species, and which contains very nearly as many species as all the others together, is liable to the same objections as the original genus, to the same uncertainty, the same confusion, and the same want of definite characters.

Such as it is, the division of De Blainville was adopted by Desmarest, and made the groundwork of that portion of his 'Mammalogie' (published in 1822) which relates to the *Antelopes*, and which forms unquestionably the best monograph of the genus ever published. Besides a copious and well-digested list of synonyms, it contains detailed descriptions of forty-five species, of which three only are nominal, one belongs to a different genus, and four others are marked doubtful, three of which, however, have since been satisfactorily verified; and, considering the poverty of his materials,—for, besides the Cape collection of Lalande and a few other species contained in the Paris Museum, Desmarest had no means of studying the animals themselves,—deserves to be considered as a monument of research and critical acumen. To the eight subgenera established by M. De Blainville he added three others, two of which, viz. the separation of the *Antelopes* proper from the *Gazelles*, and of the *Eland* from the *Koodoo* and *Boshbok*, were decided improvements; the third destroyed M. De Blainville's best group, by separating the *Aigoceres* and *Oryxes*, which we shall afterwards find to compose a perfectly natural genus; and the residual group, the greatest defect of that naturalist's distribution, remained unchanged in the hands of his successor. To give some idea of the arbitrary and artificial construction of this group, I shall here set forth its characters as given by Desmarest, and it will be at once seen that they are neither sufficiently general nor sufficiently exclusive to be applicable to practical purposes, much less to entitle them to be considered of scientific importance.

"Cornes simples, tantôt à courbure antérieure ou postérieure, tantôt droites, peu ou point annelées (à l'exception de celles de l'Antilope cambtan), sans arête, dans le mâle seulement, ou dans les deux sexes; souvent des larmiers; muffle manquant ordinairement; point de brosses (si ce n'est dans l'Antilope ourebie); des pores inguinaux; quatre mamelles (l'Antilope des buissons exceptée); queue courte[1]."

[1] Desmarest, 'Mammalogie,' p. 457.

Throughout this long and complicated definition, the inguinal pores and short tail are the only characters which the authors even pretend to be common to all the species; and this, as far as regards the inguinal pores, is far from being the fact; the rest are utterly inapplicable in practice, from the uncertainty in which they are involved and the exceptions to which they are liable; so that, instead of being enabled to recognize species by the definition of M. De Blainville, it is necessary to have a previous knowledge of the species, in order to understand the definition. This is reversing the ordinary purpose and practical use of all systematic arrangement, and it is not surprising, therefore, that Baron Cuvier, even so lately as 1829, on the occasion of publishing the second edition of the 'Règne Animal,' should have rejected so fallacious a system, and returned to the old method of subdivision, according to the form and curvature of the horns.

In a scientific point of view, De Blainville's distribution of the *Antelopes* was of advantage to zoology, by introducing among the characters of the genus the consideration of the muzzle, a very important part of the structure of these animals, which Illiger had already employed; but this advantage was more than counterbalanced by the accumulation of purely trivial and arbitrary characters with which it is mixed up, such as the mere form and curvature of the horns, the existence of scopæ and inguinal pores, the length of the tail, the number of mammæ, and even the presence of longitudinal dark bands on the flanks.

Next in succession came the monograph of Colonel Charles Hamilton Smith, which was published in 1827, and occupies the greater portion of the fourth volume of Griffith's translation of the 'Règne Animal.' The principal merit of Colonel Smith's memoir consists in the resolution of the residual group of De Blainville and Desmarest, which he subdivides into eight minor groups, in all respects more definite and natural than the original; his other groups coincide, for the most part, with the divisions of these naturalists, except that species are occasionally removed, not always judiciously, from one division to another. As a monograph, Colonel Smith's work is extremely defective: it bears every mark of having been hastily written, and without a proper regard to criticism in the selection of its materials; it is entirely without synonyms, references, or any quotation of authorities; the specific descriptions are generally vague, often imperfect, and seldom or never comparative; the specific characters are generally compiled, chiefly from Desmarest, and are frequently erroneous; and the generic and subgeneric diagnoses as vague, complicated, confused, and burthened with trivial characters, as can well be imagined. Out of eighty species enumerated and described in this memoir, at least twenty-four are purely nominal; eight others were doubtful at the period of Colonel Smith's publication (of which, however, three or four have since been satisfactorily authenticated), and four belong to different genera; so that upon the whole the number of authentic species does not materially differ from that given by Desmarest. Of the twenty-four nominal species, again, Colonel Smith is himself answerable for the introduction of no fewer than sixteen; three of the doubtful species, likewise, rest upon his authority alone, and I cannot at the present moment give him credit for throwing any additional light upon more than three or four of the remaining species. Yet, notwithstanding all these disadvantages, Colonel Smith's treatise has not been without its use in promoting the study of the *Ruminantia*, and the development of their natural characters; it is more copious in details than any other work on the subject; it contains the results of long experience, though unfortunately the author does not appear to have thoroughly digested his extensive knowledge; but it requires to be read with caution, and the specific characters can seldom be received with implicit confidence.

Colonel Smith is, as far as I am aware, the only zoologist who has proposed the formation of new and distinct genera from among the ample but discordant materials of the Antilopine group; but, considering his long and familiar acquaintance with the subject, his attempts are by no means so judicious or successful as might have been expected. His genus *Catoblepas*, for instance, has precisely the same essential characters as the *Bubalus*, the *Caama*, and the *Sassaby*, yet all these animals are placed in a different genus, and associated with species to which they bear no natural affinity. The proposed genus *Damalis* again, is composed of species which absolutely have not a single character in common, besides those which belong to them as hollow-horned Ruminants; so that Colonel Smith is himself obliged to confess "that it is very difficult to establish characters sufficiently general to justify the proposal of this new genus[1]." Those which he has selected are purely arbitrary, and without the slightest influence on the habits and œconomy of the animals; they are assumed principally from the comparative stature, the elevation of the withers, the cancellated structure of the osseous core of the horns, and other similar attributes, and are all equally vague and unimportant. In a group so loosely constructed, and so arbitrarily defined, we need not be surprised to find the most opposite and dissimilar species united. Thus we have the *Bubalus* and *Caama*, distinguished by their naked muzzles and lachrymal glands, placed in contiguity with the *Antilope suturosa* of Otto, which possesses neither one nor other of these characters; the *Antilope oreas*, with horns in both sexes, and no lachrymal sinus, is situated between the *Sassaby*, which differs from it in the latter character, and the *Koodoo*, which is destitute of the former; the *Nyl-ghau* of India, with lachrymal glands and horns in the male sex only, is approximated to the *Eland* of the Cape, which differs from it in both these characters; and finally, to complete the confusion so prevalent throughout this ill-imagined group, we find among its species the *Antilope suturosa* of Otto, to which Colonel Smith himself attributes the same characters, and which Dr. Lichtenstein and other distinguished observers who have had opportunities of comparing the original specimens, assert to be absolutely identical with the *Addax*, as it certainly is with the *Antilope naso-maculata* of De Blainville, though the two latter names are placed in two

[1] Griffith's Trans. 'Règne Animal,' iv. 345.

distinct subdivisions of the genus *Antilope*, the same species being thus three times described in as many different subgenera.

The only additions made towards perfecting the classification of the hollow-horned Ruminants, subsequent to the publication of Colonel Smith's work, were the article 'Antelope' of the 'Penny Cyclopædia,' and a short paper on the generic distribution of this order generally, in the fourth part of the 'Zoological Proceedings[1].' In the former, the genus was divided into subgeneric groups, after the manner of Lichtenstein, De Blainville, and Colonel Smith; but the trivial characters employed by these naturalists were, for the most part, discarded; the groups were formed in strict accordance with the characters of the individual species composing them, and greater simplicity and precision were given to the definitions. The enumeration of species, however, was in many cases compiled from the works of Colonel Smith and Desmarest, and is occasionally inaccurate, the introduction of nominal or uncertain species being unavoidable in an article of that kind. In the latter, the principles which I shall presently explain at greater length were for the first time applied to the classification of the *Ruminantia* in general; and though farther observation and experience have induced some modifications, and enabled me to correct some material errors which had crept into that sketch, I believe the generic distribution of the hollow-horned Ruminants there proposed will not only be found to be based on essential, marked, and influential characters, but to be in strict accordance with the natural habits, œconomy and structure of the animals.

III. *Insufficiency and ill effect of the characters hitherto employed in the generic distribution of the Ruminantia.*

In attentively considering the preceding review of the history of classification as applied to the hollow-horned Ruminants, it will be observed that the consequences of the faulty and unphilosophical principles employed in that department of mammalogy were natural enough. The genera *Bos*, *Ovis*, and *Capra*, represented by familiar and well-known types, carried with them clear and definite ideas, and represented to the mind of the naturalist distinct and determined forms. However vague and arbitrary their generic definitions, they could not possibly be mistaken or confounded with any other groups; but the genus *Antilope* was exemplified by no common domestic species, familiar to the every-day observation of the student, whose form was associated with his earliest recollections, and whose characters were engraven upon his mind by a more indelible process than the description of the zoologist. Everything connected with this genus was vague, arbitrary, and indeterminate; the term *Antelope* conveyed no positive idea to the mind of the naturalist; or the only conception it enabled him to form was, that the animal, whatever else it might be, was neither an *Ox*, a *Sheep*, nor a *Goat*. The

[1] 'Proceedings of the Zoological Society,' Part iv. p. 136–9.

characters, moreover, upon which it is established—the form and direction of the horns, neither compressed and crescent-shaped, as in the *Goat*, nor prismatic and spiral, as in the *Ram*; nor smooth, round, and lunated, as in the *Ox*; the absence of a beard on the chin, and a dewlap on the throat, &c.—are in reality so many negative traits which distinguish all other hollow-horned Ruminants from the *Oxen*, the *Sheep*, and the *Goats*, respectively, but which limit no positive group, and which consequently cannot be received as the definitions of a natural genus. They tell you what the animal is not, not what it is; and the natural consequence has been that every Ruminant which could not be immediately associated with one or other of the old genera, was, as a matter of course, considered to be an *Antelope*, without the slightest reference to any positive, natural, or even artificial characters it might possess; so that in a short time this latter group became a kind of zoological refuge for the destitute, an asylum for the reception of all vagrant Ruminants which could not produce satisfactory testimonials of their consanguinity to some one or other of the better known genera, *Bos*, *Ovis*, or *Capra*. Thus it was that the most incongruous forms and opposite characters came to be mixed up and associated in the same genus, till, independently of its unphilosophical structure and total want of character, whether natural or artificial, the practical inconvenience arising from its undue extension—for it contains at the present moment upwards of sixty species, or above treble the number included in all the other three genera together—forced zoologists to devise the partial remedies of which I have already detailed the history, and which all proceeded upon the same common principle, that namely of dividing the genus *Antilope* into such subordinate groups as were conceived best calculated to obviate its inconsistencies, and approximate those species which most nearly resembled one another in habit and conformation.

The process employed for this purpose was purely analytical, and thence, as I conceive, arose the radical defects of the whole system, and its failure to accomplish the object which it proposed. Instead of commencing by a diligent study of the natural and influential characters of individual species, and afterwards proceeding to generalize their observations, according to the true principles of inductive philosophy, naturalists began at the wrong end, and contented themselves with analyzing the contents of the principal group. This process necessarily involves the supposition that the group in question is a natural genus, a fallacy for which it is difficult to account in the present state of science, but which is tacitly assumed by every writer on the subject, even whilst they confess that it has not a single character either exclusively appropriate or even common to the generality of its component species. Far, therefore, from being a natural, it is not even entitled to be considered an artificial group; it would be impossible ever to arrive at such a group by following the synthetic method of investigation, the only legitimate and philosophical path of induction: the so-called genus *Antilope* is in fact no group at all; for it has no positive or absolute characters whatever, and the various attempts which have been made to invest it with this distinction, have all proved signal failures. Of this nature is the diagnosis proposed by M. Geoffroy St. Hilaire[1], viz. that the *Antelopes* have the core of the horn solid, and without either pores or cancelli; and that which M. Agassiz broached at a meeting of the Zoological Society in 1833, to the effect that these animals are distinguished from the genera *Bos*, *Ovis*, and *Capra*, by having the spiral twist of the horns turning from left to right, instead of the opposite direction. Both these ideas are founded upon hasty generalizations, inapplicable to at least three-fourths of the genus; the core of the horn is as completely cancellated in all the larger species of *Antelopes* as in the *Ox* or *Sheep*; and the spiral curvature, besides being confined to a very small number of species, is in some instances turned in an opposite direction to what M. Agassiz supposes, as, for example, in the *Bubalus* and *Caama*. Even were they influential or important enough to be considered as natural characters, such attributes are not, therefore, sufficiently general to admit of being employed in the subordinate station of mere practical diagnoses; and the same may be said of every other character hitherto employed to distinguish the genus *Antilope*, as a peculiar, positive, and integral group.

It is obvious, in fact, that the form, direction, and superficies of the horns, the principal characters hitherto employed not only in defining this but all the other genera of hollow-horned Ruminants, can have no assignable influence over the habits and economy of the animals, nor any conceivable relation to their structural modifications: they do not even possess the solitary merit of artificial characters in general, that namely of being exclusively appropriate to their respective groups; and more than one instance might be adduced where even the most skilful zoologists have been misled by their application to associate particular species with genera to which they have no natural affinity. I may cite as examples the *Rocky Mountain Goat*, which De Blainville, Desmarest, Hamilton Smith, and even, as it appears, Baron Cuvier[2] himself, consider as an *Antelope*, for no better reason than because it has not the "cornua sursum versa, erecta, compressa, scabra" of the *Ibex*,—a character which, by the way, might be made to exclude from their natural congeners half the domestic varieties of the common *Goat* itself;—and the *Anoa*, in reality a small *Buffalo*, but called an *Antelope* because it happens to have straight erect horns, a character equally conspicuous in many varieties of the *Zebu* (*Bos Indicus*). On the other hand, the horns of the *Gnoos* have precisely the same form and direction as those of the Linnæan genus *Bos*; they are "*antrorsum versa, lunata, lævia*," in the fullest acceptation of the terms; yet these animals have never been associated with the *Oxen*, notwithstanding the identity of their quasi-generic characters.

The insufficiency of these principles, and the arbitrary and unphilosophical classification to which they led, were strongly felt by my late learned and estimable friend M. F. Cuvier, the most profound and scientific mammalogist of modern times. In his article on the *Chickara*, alluding to his imperfect knowledge of its characters, he ob-

[1] Cuv. 'Règne Animal,' i. 266.

[2] Ibid., i. 272 (Note 1.).

serves, "Des nouvelles observations sont donc nécessaires et suppléeront un jour, il faut l'esperer, à celles qui nous manquent; *et c'est un espoir qu'on doit étendre à presque tous les autres Ruminans à cornes creuses*, dont on n'est encore parvenu à caractériser les groupes que par la forme ou par la direction des cornes, *quoique l'observation pas plus que le raisonnement, n'ait motivé le choix de ce caractère.* En effet les cornes ne constituent encore qu'un de ces signes artificiels, manifestation constante des faibles ressources de la science qui les emploie, et des besoins dont elle réclame les secours. Aussi peut on dire qu'il n'est aucune branche de la mammalogie qui ait aujourd'hui plus besoin d'observations nouvelles; et la preuve que la structure des cornes est insuffisante pour établir les rapports naturels des ruminans, c'est que depuis Pallas jusqu'à ce jour, l'emploi de ces organes, comme caractères génériques, n'a conduit qu'à former des divisions arbitraires, dont l'infécondité suffisait seule pour démontrer les vices. Au reste, c'est peut-être aux difficultés que présente l'étude de ces animaux, difficultés qui ne se rencontrent dans aucun autre ordre, dans aucune autre famille au même degré, que la mammalogie devra des observations plus détaillées que celles qu'elle possède aujourd'hui; on verra peut-être alors que des particularités qui n'avient été l'objet d'aucune attention se lient plus directement au reste de l'organization que des parties plus importantes en apparance parcequ'elles sont plus étendues, plus sensibles; et ce nouvel ordre des connaissances, conduisant a des nouveaux rapports, ouvrira aux recherches de la Zoologie un champ plus fertile et plus important[1]."

But, independently of the primary fallacy of considering the genus *Antilope* as a natural or even an artificial group, other causes contributed to defeat the intentions of those zoologists who have laboured to amend its defects or remove its inconsistencies, and to lessen the value of even the partial reforms they were able to accomplish. Of these the principal were the narrow bounds within which they confined their projected improvements, limiting their views to the genus *Antilope*, instead of extending them to the whole family of *Hollow-horned Ruminants*; and the mixture of arbitrary, trivial and variable characters, with those which are more permanent and influential. The former was, in a great measure, the immediate result of the primary fallacy above mentioned, since the principle of considering the genus *Antilope* as a natural group prevented the extension of the investigations undertaken with a view to its improvement, to the genera *Bos*, *Ovis*, and *Capra*, and disguised the purely arbitrary and indeterminate nature of the distinction between these groups and the so-called genus *Antilope*: the latter arose from the reprehensible but invariable practice of confounding *general* with *generic* characters, without distinguishing between such as are *essential* and such as are merely *accessory*. Now it is a principle so obvious, that no man of rational, much less of philosophical mind, will for a moment doubt its truth, that the mere form and curvature of the horns, the beard, the dewlap, the scopæ, the number of teats and other such diagnoses hitherto

[1] Hist. Nat. des Mamm. fasc. 44.

employed to define the genera of Ruminants, are purely trivial and accidental characters, which not only exercise no assignable influence over the habits or œconomy of the animals, but which may be modified to any extent, or even destroyed altogether, without in the slightest degree changing their generic relations. The small Indian *Zebu*, for example, is not the less a *Bos* for having perfectly upright horns, nor the common *Buffalo* for being without a dewlap: the Rocky Mountain *Goat* does not cease to belong to the genus *Capra* (at least as nature has formed it) because its horns are short and smooth, nor the Wallachian *Ram* to the genus *Ovis* because it happens to have these organs as erect and spiral as the *Koodo* or the *Addax*. All these are, in truth, accessory and variable characters, mere modifications of form produced by food, climate, and other casual circumstances; they do not even indicate *specific* differences, much less *generic*; and their employment, in the latter sense, is but an example of that empiricism which has so long burthened every department of zoology, and retarded the development of its true philosophical principles.

But besides these errors of theory, there were practical difficulties which formed an insurmountable obstacle to the subdivision of the genus *Antilope* into definite or natural groups. These arose from the extremely defective and incorrect manner in which the individual characters of the different species have been hitherto observed and recorded. In fact, no regular or express study of these characters had ever been undertaken in detail; detached and occasional observations were, no doubt, made upon particular species in the process of general description; but no regular system was pursued, no patient and oft-repeated comparisons instituted, for the purpose of correcting the defects or imperfections of individual specimens; nor was there any appreciation of the superior value of some characters over others: add to which the difficulty of making such minute observations on dried skins or mounted specimens, where the organs are not unfrequently distorted, concealed, or altogether destroyed in the process of preparation, and the causes will be readily perceived as well of the deficiencies and numerous errors which pervade all the generic monographs and most of the specific descriptions hitherto published, as of the contradictory characters occasionally assigned by different observers to the same species. Such being the case, it is evident that nothing was to be expected from compilation; yet to this alternative former monographers were in a great measure reduced, by the poverty of the materials at their disposal, for such facts as related to the lachrymal and inguinal glands, the number of teats, and other characters which form the groundwork of their subdivisions; and the circumstance is alone sufficient to account for the failure which has confessedly attended their efforts. I have already observed that two very distinct courses were pursued for the attainment of this object. Whilst some, like Pallas, Cuvier, and Lichtenstein, assumed one or more characters without reference to individual species, and made their divisions depend on these predetermined principles, others again, like De Blainville, Desmarest, and Hamilton Smith, without any primary reference whatever to characters, but according to some vague and indefinite notions of resemblance, picked out certain species which they chose to consider as composing a subgenus, and then elaborated the definition of the group thus formed from the characters, as far as they knew them, of the component species. The first process is the result of true philosophical induction, provided the characters assumed have been previously ascertained, by a detailed and careful study of the individual species, to be those which actually influence the habits and œconomy of the animals, and will infallibly lead to a natural and scientific classification where the characters are properly chosen; nay, even where the choice is purely arbitrary, it will at least produce a simple, logical, and definite agroupment, though of course the composition of the different groups may be heterogeneous and unnatural; the second is pure undisguised empiricism, and must invariably produce the complications, contradictions, exceptions, and accumulation of trivial and unimportant characters which have been already noticed, and that too without being in any degree more natural or homogeneous than divisions formed on the opposite system.

Having thus demonstrated the imperfections of the actual distribution of hollow-horned Ruminants, the arbitrary and indefinite limits of the different genera, and the trivial, variable, and unsuitable nature of the characters employed to distinguish them; having traced the origin, progress, and extent of the evil, and shown the necessity of a searching and effectual reform;—it only remains for me, before proceeding to the exposition of the principles which I propose to make use of for this purpose, to state the sources of my own knowledge, and explain the nature and extent of my researches. When I commenced the study of the genus *Antilope*, so long ago as the year 1830, the museums of this country were extremely deficient in specimens of this family; certainly not more than ten or a dozen perfect species were contained in the National Collection and that of the Zoological Society together, and these were of the commonest forms; so that I was not at that time within reach of sufficient materials for the study of specific differences, much less of generic relations. Scanty as they were, however, the museums just mentioned, that of the Missionary Society and a collection of Cape mammalogy, formed by M. Villet, and exhibited at the Egyptian Hall in the year 1828, contained enough to convince me of the perfectly arbitrary and unphilosophical composition of the genus *Antilope*; and from that moment I set myself seriously to study the essential characters and habits of the individual species, with the view of arriving at such generalizations as should at once embrace the natural relations of the animals, and place their classification on the basis of a firm philosophical induction. The arrival of Mr. Steedman's extensive collection of South African mammals in 1833 was an important addition to my previous stock of materials; and the collections of the Zoological Society and British Museum—the former containing at the present moment forty-six distinct species, and the latter very nearly as many—increased with a rapidity far beyond my most sanguine hopes. Since that period I have carefully examined and compared the magnificent collections of Leyden, Frankfort, and Paris; that of the South African Society, brought over by my friend Dr. Smith; Dr. Burchell's; and numerous smaller collections and single species, besides a vast number of skulls, horns, and other fragments; so that upon the whole I have minutely and repeatedly observed and compared together upwards of sixty distinct species of *Antelopes*, of the greater number of which I have seen numerous individuals, of all ages and sexes, upon every new specimen of which I took care to verify the characters previously observed; nor is there a single authentically described species, with the exception of the *Antilope gutturosa*, of which I have not personally ascertained the essential characters.

When I first began to apply the principles which I observed to influence and control the habits and relations of the few species I was then thoroughly acquainted with, to the generic distribution of the hollow-horned Ruminants in general, or in other words to extend my inductions from the species I knew to those which I had not had an opportunity of studying, I found the results very different from what I had reason to expect, and that they had the apparent effect of associating together in the same group animals which differed materially in habits and œconomy, as well as in external form. This certainly surprised me, but it did not shake my confidence in the value and importance of the characters I employed, and which were founded upon those modifications of organic structure which I knew to influence the œconomy of the animals I was acquainted with; I rather suspected the fidelity of the specific characters given by Desmarest and Hamilton Smith, upon whom I was chiefly obliged to rely for my facts; and subsequent observations fully confirmed the justice of my suspicions and the correctness of my principles, by proving that the inductions in question, when applied with correct data, led to a generic distribution of the hollow-horned Ruminants in strict accordance with the natural habits and relations of the animals. In fact I found, as I proceeded, that between vagueness of expression, omissions, and actual errors, there was scarcely a specific description of these authors which could be implicitly relied on even for the most marked and prominent characters; whilst one of the most important and influential organs, the interdigital pores, had been entirely neglected, and other modifications attributed to the animals which I knew to be at variance with their habits and œconomy. The necessity of an extensive and minute study of specific characters was thus forced upon me; but I had the satisfaction to find that the laborious researches and oft-repeated observations which I undertook in consequence, confirmed, in the amplest manner, the value of the inductions I had previously made from more limited facts, and reconciled the inconsistencies and anomalies which their general application had apparently produced in the first instance.

Whilst this process of generic construction and specific verification was going on, I pursued a simultaneous course of extensive and unwearied research, for the purpose of ascertaining the peculiar or appropriate habits and œconomy of the animals themselves. The works of all African and Eastern travellers, which appeared likely to contain information on this subject,—more especially those of our own language, so rich in this department of literature—were consulted with the greatest advantage, and a copious list of references and synonyms collected, of which the principal will be given under their proper heads in the subsequent parts of this monograph; but it was chiefly from private sources, from the information communicated by colonial gentlemen and officers, the greater number of them keen sportsmen, and well acquainted with the large game of Africa and India, that I learned the characteristic habits of the different species, and was enabled to generalize and perceive their relation to peculiar modifications of organic structure.

I now proceed to the exposition of these essential characters, their influence upon the habits and œconomy of the animals, and their application to a natural and philosophical generic distribution of the hollow-horned Ruminants in general.

IV. *Inquiry into the essential characters of the Ruminantia, and the principles of their generic distribution.*

I have often, during the course of the last ten years, both in conversation and in print, before this Society and elsewhere, taken occasion to insist upon that primary, but, I regret to say, neglected law of classification, *that no generic characters should be admitted but such as are founded upon the necessary relations that subsist between the organic structure of animals and their habits and œconomy.* If zoology is to be considered as a legitimate branch of science its principles must be founded upon some more permanent and influential relations than the trivial and evanescent characters too commonly employed to distinguish genera, and which have hitherto made it a barren system of empiricism, a dry catalogue of concrete facts, without any of those higher and more refined generalizations and inductions which constitute the soul and essence of true philosophy. All philosophy is the knowledge, not of simple facts, but of their relations; and philosophical zoology I would define as "*The science which treats of the relations which subsist between the organic structure of animals and their habits and œconomy.*" This branch of zoology is still in its infancy; the descriptive part of the science has indeed made rapid progress within the last half century, and still continues to advance; but it is a very subsidiary department, and the vague, arbitrary, and unsettled nature of its principles has given rise to all the various artificial and conflicting systems which have so much embarrassed the science, and which depend merely on the caprice of their authors. The true natural system is that which classifies the relations of the animal kingdom according to the great law above expounded: it is the only system whose principles are fixed and immutable, whose characters are impressed with the stamp of Creative Wisdom, and can be altered neither by the caprice of man nor the freaks of accident. To the development of these great philosophical principles I have invariably directed the chief part of my attention in all my zoological pursuits; I now proceed to apply them to the classification of the hollow-horned Ruminants, and I could not possibly desire a more favourable group to exemplify their effect, whether we consider the deficiencies of the prevailing distribution or the natural and lucid arrangement of which the application of these principles will show them to be susceptible.

Besides the peculiar characters furnished by the conformation of the stomach, which are common to all Ruminants, and those derived from the modifications of the teeth and extremities, in which the *Camelidæ* alone offer any very marked difference, there are others, of a less general nature indeed, but which nevertheless are neither destitute of importance nor of a very considerable influence upon the habits and œconomy of the animals. These characters, most of which are peculiar to the *Ruminantia*, may be conveniently classed and considered under the following heads:—I. Horns; II. Form of the upper lip; III. Crumens and other glands; and IV. Feet and digital pores.

I. Horns.—Under this head are to be considered—1. The substance of the horns; 2. Their permanent or deciduous character; 3. Their presence or absence in different genera and sexes; and 4. Their number, forms and flexures.

1. *Of the substance of the Horns.*—All ruminating animals which possess these organs have them supported upon peculiar processes of the *os frontis*, of greater or less extent, according to the nature of the horn and the age of the individual. In the *Cervidæ*, generally speaking, they are thick and short, and have the horn articulated by a flat granular surface to their upper extremity; yet in the *Muntjacs* they are so slender and prolonged as to exceed the length of the horns themselves; and in the *Giraffe* they entirely supply their place. In all the hollow-horned genera they are likewise long, but slender and attenuated, and assume the various forms and curvatures that regulate the figure of the horny sheath into which they are inserted, and to which they form a core or support. In some cases the substance of this bony core is solid, or at least penetrated only by minute pores; in others, and they are by far the greater number, it is partially hollow, or filled with large cancelli, which communicate with the frontal sinuses. These varieties are not confined to any particular groups, but are equally common both to solid and hollow-horned genera. The *Giraffe*, for instance, has very extensive cancelli; so likewise have the *Oxen*, *Sheep*, *Goats*, and all the larger species hitherto classed among the *Antelopes*; nor have I found the solid core, so much insisted on as a generic character by MM. Cuvier and Geoffroy St. Hilaire[1], in any of these animals, except the *A. cervicapra*, the *Dorcas*, and their allied species.

The texture of the horn itself is of much greater consequence than that of the core or process which supports it. In the *Deer*, as is well known, it consists of solid bone, which is shed and renewed periodically; in all the other horned Ruminants these organs are of an excrementitious substance, similar to the hoofs and hair; they are hollow within, and cover the osseous process like a sheath or scabbard. Hence we have the two great families of *Solid-* and *Hollow-horned Ruminants*, a distinction which carries

[1] Règne Animal, i. 266.

along with it consequences of greater moment than the mere texture of the horn. In the former class the young horn is covered with a vascular skin which supplies it with nutriment, and the growth goes on simultaneously and without interruption, from the upper extremity, till the organ is completed; the vessels then dry up, the skin exfoliates, and leaves the surface of the horn smooth, or marked with minute pearly granulations, and nearly of the same thickness throughout. In the latter the horns receive their increments at the lower extremity; they continue to grow throughout life, but only at intervals, depending upon the season of the year, the age of the individual, and the supply of food. The outer surface is consequently marked in general with a greater or less number of prominent transverse rings or annuli, more or less contiguous, nnmerous, and projecting, according to the age, sex and species of the animal, and occasioned by the interruption which the growth of the horn suffers at particular seasons, and the superabundance of nutritious matter supplied to it at others. The number of these annuli depends upon two circumstances, the species of the animal and the age of the individual. In the adult *Addax* and *Leucoryx* they amount to between thirty and forty; whilst in the *Madoqua* and *Duikerbok* they seldom exceed three or four. In some species they are scarcely perceptible, whilst in others they form prominent knobs; some have them completely surrounding the horn, others only in front; in some the interstices are beautifully marked with longitudinal striæ, in others plain; but in all cases the rings are most distant towards the points of the horns, and more nearly approximated as they approach the base. The terminal quarter at least is usually smooth and pointed, and as this part is the earliest developed, it follows that all young animals have the horns of this smooth polished character: it is only when they arrive at maturity, and are fit for propagation, that the horns begin to exhibit annuli, but the number of these added in a given time appears to be very variable. The common *Cow* is generally supposed to acquire one ring on the horn every year after the third, but this is far from being a general law. Between the 20th of July and the 31st of October 1833, the horns of a young Indian *Antelope* (*A. cervicapra*), which I had marked for the purpose, in the gardens of the Society, acquired an addition of no fewer than three rings, and an increase in length of a full inch and a half; and I have observed a similar phænomenon in other species.

2. *The permanent or deciduous character of the horns* depends on their hollowness or solidity. Hollow horns are usually considered synonymous with permanent, but this is not strictly correct; solid are for the most part deciduous, and that in general annually. According to Sir T. S. Raffles[1], the *Muntjacs* seldom shed their horns, and the opinion is countenanced by my own observation of different specimens in the Society's gardens. An individual formerly presented by Colonel Sykes shed one of its horns early in 1832, and had not completely renewed it in the autumn of the following year; the other horn was never shed, though the animal throve well and always enjoyed good health. Colonel

[1] Linn. Trans., xiii. 265.

Hamilton Smith[1] and Don Felix Azara[2] observed the same phænomenon in the pricket-horned *Deer* of South America; not indeed that these animals never shed their horns, as might be inferred from the vague expressions employed by the former naturalist, but that they do so at more distant and irregular intervals than the larger species of temperate and northern climates. The *Giraffe* alone differs from all other solid-horned Ruminants in this respect. It is true that this animal wants the actual excrescences which form the horns of the *Deer* kind, but it does not on that account cease to belong to the same natural family; the difference is rather in degree than in kind; the *Giraffe* has the same long frontal processes as the *Muntjacs*, and is in that respect intermediate between that section of the *Deer* family and the *Camelidæ*.

The hollow horn is likewise shed, but in a different sense from the solid. Buffon[3] has been ridiculed for asserting this fact with regard to the domestic *Ox*; but Buffon was a much better observer than his critics, and I have myself verified his observation on many other Ruminants. If the horns of any young animal be examined, it will be found that they are of a coarse, scabrous, spongy texture, very thick and blunt in proportion to their length, and hollow nearly to the point: let the same individual be examined when it arrives at maturity; the horns, especially towards the extremity, have a close, compact, and polished surface; they are much attenuated, end in a very fine point, and have the terminal third perfectly solid. These changes do not arise from the mere rubbing and polishing of the horn, as is commonly supposed. That hypothesis does not account for the difference of texture and solidity which distinguishes the old and young horns; but the truth is, that, as in the case of the second dentition, the permanent organ is developed under, or rather within the other, and by its growth gradually carries it upwards, and supports it like a sheath or scabbard. The young horn, thus severed from the vessels which formerly supplied it with nutriment, dries up, bursts from the expansion of the permanent horn within it, and exfoliates in large irregular stripes, leaving the latter with the finely polished surface and solid, sharp, attenuated points which distinguish them. As far as my observations enable me to judge, this exfoliation takes place only once during the life of the animal, and that at the period of adolescence, immediately before the appearance of the first annulus. Though it does not take place all at once, nor absolutely deprive the animal of horns for a certain period, it is nevertheless a true and actual shedding of these organs, and accounts satisfactorily for many phænomena which I found inexplicable before making these observations. The horns of the *Oryxes*, for instance, which in the adult state are remarkable for their straightness and extreme sharpness, have the points very blunt and bent backwards, almost at a right angle, in the young animal; and the *Koba* or *Sing-Sing*, whose permanent horns are partially lyrated, has the young organs nearly straight, as may be observed in the specimen now in the Society's Museum. It is only necessary to observe further, that the young horn which afterwards exfoliates, appears to be entirely the growth of the first year, though

[1] Griff. Anim. King., iv. 68. [2] Quad. du Parag., i. 49, 50. [3] Hist. Natur., iv. 459.

it generally remains a much longer time before being cast; a young *Leucoryx* in the museum at Frankfort, with horns eighteen or twenty inches long, has the points still bent, exactly as in another specimen where they are only two inches long.

Now this permanence or deciduousness of the horns—for in a general sense, and especially as contrasted with the solid organs of the *Deer* kind, the hollow horn may always be considered as permanent—is a constant and invariable character, which has a direct and powerful influence upon the habits and œconomy of the animals. The *Deer* kind invariably affect particular localities at the period of casting and renewing their horns: their manners then undergo a complete change; from bold and daring, they become timid and irresolute; they lose their flesh, abandon the open hills and upland plains for the thick cover of the forest, and, foregoing their gregarious habits, desert their companions, and pass the period of weakness in solitude and seclusion. As soon, however, as the new horn acquires strength and solidity, the *Stag* resumes his usual habits and regains his former confidence. Hollow-horned Ruminants present no such phænomena; the habits and manners of the same species are similar at all seasons, and the differences which we observe in different species depend upon other causes, which will be developed in the sequel. The modifications of organic structure which produce these different effects are too permanent and influential to be neglected among the characters of a natural classification of the Ruminants. Nor have they been overlooked by zoologists; it may be said, indeed, with truth, that they constitute the only really important characters hitherto employed to distinguish the genera of these animals.

3. *The presence or absence of horns in different species and sexes* furnishes another character which has already been partially employed in the distinction of genera, though not to the full extent it is susceptible of, or that its importance merits. The *Camelidæ*, so anomalous in many other respects, differ also from the generality of other Ruminants, in the total deprivation of horns. So likewise do the *Musks*, a much less abnormal family; and these two groups comprise all the known Ruminants in which the males want these organs as well as the females. About half the remainder, however, exhibit this character partially, by having the horns confined to the male sex; and this structure has a very powerful and evident influence upon the habits of the animals. The whole of the solid-horned family, with the exception of the *Reindeer*, are in this predicament, as are likewise about thirty of the hollow-horned species hitherto classed among the *Antelopes*. In the former case—that, namely, in which both sexes are hornless—the weight of the character has been duly appreciated by zoologists; in the latter it has been totally neglected as a generic distinction. Its influence, indeed, is more obvious and powerful in the one case than in the other; but if we consider the necessary consequences of even a partial deprivation, and apply the principles thence derived to the study of the animal œconomy; if we compare, with this intention, the character of those Ruminants which have horns in both sexes, such as the *Oxen*, *Bubals*, and *Oryxes*, with the habits and manners of those species which have them confined to the

male sex only, we shall not fail to observe the influence of the character deeply marked in the different effects which it produces on the œconomy of these two classes. We shall find the hornless females remarkable for their extreme gentleness and timidity; we shall find the males participating more or less in these attributes in all cases, but especially among the *Deer* kind at the period of shedding and renewing their horns; we shall find both sexes more remarkable for cunning and circumspection than for courage or force of character, trusting their safety to flight or stratagem rather than defence; cautious in all their actions, extremely suspicious of strange objects or appearances, and detaching sentinels to the outskirts of their encampments, to give timely notice of the approach of danger, in the unguarded moments of feeding or repose: finally, we shall find them either perfectly monogamous, or residing in small detached families, composed of a single adult male and a variable number of females, with the young of one or two preceding seasons, occasionally uniting into numerous flocks for the purpose of migration, but always resuming their family habits when this necessity is satisfied, and adhering throughout life to the same sexual attachments. The cause of all these phænomena is evidently to be found in the defenceless situation of the females, which compels them to place themselves permanently under the guidance and protection of the better armed sex. Did they reside in large herds and hold miscellaneous intercourse, the bond of social union between the sexes would be comparatively weak, and the males, having little personal interest and no individual attachments, would show little spirit in defending the females. But in small families the case is different: long familiarity and privity of sexual intercourse produces attachment, if not affection, in the mind of the male; he guards his family with jealousy, and defends them with courage.

On the other hand, those Ruminants which are distinguished by having horns in both sexes, are as bold, daring and independent, as the others are gentle, timid and irresolute. These reside generally in large herds, have a community of sexual intercourse, contend fiercely for the possession of the females, rarely attach themselves to particular individuals, and often exhibit a degree of stupid and brutal ferocity, in other respects foreign to the character of herbivorous animals; the old males frequently abandoning the herd after the rutting season to live in savage and morose solitude. The vindictive and malicious character of wild cattle, of the *Arnee* of India, the *Buffalo* of the Cape and the *Bison* of America; the fierce and resolute spirit with which the *Gnoos*, and even the common *Gazelles* defend themselves when wounded, or unite to repel the attacks of wild beasts; the known danger of approaching the *Gemsbok* of Southern or the *Algazel* of Northern Africa, the

> Cornua acuta ferens, animisque ferocibus iram,
> Formidandus *Oryx*, homines ferasque lacessens,

of Oppian, are a few of the many instances which might be produced in proof of this distinction. It is not here meant that all Ruminants which have horns in both sexes are on that account necessarily gregarious; this is, nevertheless, the general rule, though it suffers some exceptions in the case of the *Oryxes* and a few species of *Gazelles*; but it is clear that their daring and independent character, their fierce spirit, and the weakness and evanescence of the sexual tie, are directly attributable to this circumstance, since the females, being provided with arms as well as the males, are equally free and independent, and neither require nor seek for protection.

It follows naturally from these considerations, that a character which so powerfully influences the habits and manners of the *Ruminantia* ought not to be neglected or undervalued among the principles of their generic distribution.

4. The fourth and last view under which it is necessary to consider the horns of the Ruminants as affording characters for generic distinction, is with regard to *the number, form, and peculiar curvatures of these organs*; and (1.) as to their *number*. In a state of nature this is almost invariably two; the *Chouka* or *Chousinga* (*A. pseudoceros*, n. s.), indeed, has an indication of a second or spurious pair of horns in front of the real ones; but the *Chickara* alone naturally possesses four; though this, and even a greater number, are occasionally seen in particular breeds of domestic *Sheep*. Dr. Leach formerly proposed to found, upon this character, a genus for the reception of the *Chickara*, to which he gave the name of *Tetraceros*; but the suggestion met with no favour from contemporary naturalists, and it deserved none; for since the *mere number* of the horns cannot be conceived to have the most remote influence upon the animal œconomy, it is manifestly unfit to be made the basis of generic distinction in any arrangement founded upon natural and scientific principles. (2.) *As to the form of the horns*: of this there are two principal varieties, the simple and the branched, and these, with a few slight exceptions, are confined to the hollow- and solid-horned families respectively. Hollow horns are all simple except in the solitary instance of the *Prongbuck*; but the peculiar forms and curvatures which they assume are extremely various. They are prismatic in the *Sheep*, compressed in the *Goats* and *Gazelles*, depressed in the *Buffalos*, cylindrical in the *Oryxes* and some bovine species; sometimes they are smooth, sometimes scabrous or striated, but most commonly annulated or marked in front with large projecting knobs, as in the *Ibex*: in the common *Gnoo*, the *Musk Ox* and the *Bos caffer*, the base of the horn expands into a solid helmet which covers the whole forehead of the animal; and this circumstance, so totally unimportant, and neither peculiar to the *Gnoo* nor common to its allied species, has nevertheless been made one of the leading characters of Colonel Smith's proposed genus *Catoblepas*; a name, by the way, which is very improperly bestowed upon a South African species of which the ancients could have no knowledge, and which really belongs to the great *Buffalo* of Ethiopia. The branched form, again, is common to all the solid-horned Ruminants except the *Giraffe* and the pricket-horned *Deer* of South America. Generally speaking the beam or principal shaft of the horn is long and cylindrical, with a variable number of antlers or branches projecting from it; but in the *Elk*, *Reindeer*, *Fallow Deer*, and some fossil species, it is more or less flattened like the palm of the hand, and

has the antlers growing like fingers from its circumference. Colonel Smith[1] supposes that this palmated formation may be intended by Nature to enable the *Elk* and *Reindeer* to shovel away the snow from the mosses upon which they feed in high northern latitudes; but besides the difficulty of conceiving how the palmated part could be brought to bear for such a purpose, it is to be observed, that the formation is neither common to all the boreal species nor peculiar to the polar regions. The *Wapiti*, which inhabits the same territories as the *Elk*, has round horns like the common *Stag*; the *Reindeer*, though living much further north, where the snow lies all the year round, has the palmature much smaller than the *Elk*; and finally the *Fallow Deer*, as its allied fossil congeners did before it, inhabits temperate climates, where snow seldom lies above a month or six weeks at a time. Upon the whole, therefore, there appears no good reason to suppose that the habits and characters of ruminating animals are in any degree influenced by the mere form and figure, any more than by the number of their horns; I shall consequently neglect these circumstances altogether in considering the generic characters of the Ruminants; and though in so doing I am opposed to the practice of many distinguished zoologists, I venture to hope that the observations which have just been offered will fully justify my dissent. (3.) *The directions, curvatures and flexures of the horns* are likewise of many different kinds and degrees. Sometimes they are perfectly straight and annulated, as in the *Gemsbok*; or straight and surrounded with a spiral wreath, as in the *Canna* (*Oreas*); sometimes they have a single curvature, either backwards, as in the *Goats* and greater number of the *Oryxes*, or forwards, as in the *Reitbok* and some others, or inwards like a crescent, as in the common *Ox* and *Sassaby*; sometimes they are lyrated, or have a double curvature in the same plane, first backwards and then forwards at the point, which is more or less the case with all the *Gazelles*, and a considerable number of my new genus *Calliope*; and finally, they have frequently a spiral curvature in different planes, either horizontal and sideways, as in the *Sheep*, or vertically upwards, as in the *Indian Antelope*, the *Addax*, the *Koodoo*, the *Boshbok*, and their allied species. In this last, or spiral form of the horn, it is to be observed that the *Sheep* differ from the *Antelopes*, except the *Bubalus* and *Caama*, in which, however, the character is but partially developed, by having the horns twisted in the contrary direction, as observed by M. Agassiz. Not that the rule is altogether so simple as that eminent naturalist laid it down, on the occasion before alluded to, viz. that the spiral runs from left to right in the *Antelopes*, and from right to left in the *Sheep*, which is true only of the left horn, the curvature of the right being in both cases turned in the opposite direction respectively; so that the right horn of the *Antelope* is twisted in the same direction as the left horn of the *Sheep*, and *vice versâ*.

Now all these various flexures and bendings of the horns, as well as their number, form and direction, have no assignable relation to the habits and œconomy of animal

[1] Griff. Anim. King., iv. 75, 84.

life. As Baron Cuvier has very justly observed[1], they do not even afford characters for the distinction of species; and it is difficult to imagine how they could ever have been selected for the more important office of generic diagnoses, as they have been by most zoologists, without even excepting Baron Cuvier himself. In conclusion, the result of these inquiries proves, that, besides their hollowness or solidity, their permanence or deciduousness, the horns furnish only one other character of sufficient influence and importance to be employed in the generic distribution of the Ruminants, viz. their presence or absence in the female sex. All the other characters which have been assumed from the form, curvatures, and number of these organs are purely arbitrary, and must be rejected from among the principles of a natural classification.

II. Form of the Upper Lip.—This is another character which has a very decided influence on the habits and œconomy of ruminating animals. The *Ox* has the upper lip terminated by a thick, heavy, naked, callous muzzle, entirely destitute of sensation, and incapable of being used as an organ of prehension, from the absence of appropriate contractile muscles. The *Goat*, on the contrary, has this part thin and finely attenuated, endowed with great mobility, and adapted to every purpose of touch and prehension. Now if the *Ox* be observed feeding, it will be found that he uses his heavy muzzle to press down a quantity of grass on one side, without distinction, whilst with the tongue he draws it into his mouth and crops it on the other. In the *Goat* this operation is conducted in a totally different manner. Instead of being obliged, like the *Ox*, to eat at random every herb or grass that happen to be mixed up together in the sward, the attenuated and moveable structure of his upper lip, acting in opposition to the under with the same effect as a finger and thumb, allows him to select or cull out particular plants from the general mass of the herbage. He is not, therefore, an indiscriminate feeder, like the *Ox*, but extremely choice in his tastes; he is not *graminivorous*, but more properly speaking, *herbivorous*; and this distinction, though it has never been properly appreciated by zoologists, has not altogether escaped the notice of Dr. Paley[2], nor even of the common people, since distinct terms are applied in all languages to these two different modes of feeding. The *Ox*, for instance, is properly said to graze, that is, to eat grass; the *Goat* to nibble or browse, which literally means, to crop the leaves and tender shoots of trees and shrubs—from the old French wòrd *brosse*, a bush; and these habits are strictly true, not of the *Ox* and *Goat* alone, but of all other Ruminants which possess the particular modifications of the upper lip exhibited in these two species respectively. Nor is the character merely external; it equally affects the osteology of the skull. The intermaxillary bones in the one case are squared and turned up at the extremity, with rough, thick scabrous rims to support the broad heavy muzzle; in the other they are gradually attenuated, and end in thin sharp points, with smooth edges and a downward aspect; and this is the surest test of the character, even

[1] Cuv. Oss. Foss. iv. 108. [2] Nat. Theol., cap. xii. sec. ii.

where the external appearance, as sometimes happens, is deceptive. Between these two extremes, however, there is considerable gradation in the development of the muzzle, and the habits of the animals undergo a proportionate modification. The *Bubals* and *Oryxes*, for instance, have this organ but half developed, and we shall afterwards find that they are as obviously intermediate in manners and œconomy as they are in organic structure. A small subgenus of *Bos*, on the other hand, including the *Muskox* of the Polar regions, and the *Yak* which represents it on the elevated plains of central Asia, have the upper lip covered with hair, but it is at the same time thick, callous and unprehensile, and has in other respects all the characters of the true bovine muzzle, as is proved by the form of the intermaxillary bones; and the hairy covering, in fact, appears to be only a provision of nature, as in the parallel instances of the *Elk* and *Reindeer*, to defend the organ from the extreme cold of the rigorous climates which these animals inhabit.

But it is not only by an indiscriminate use or more choice selection of food that these two classes of ruminating animals are distinguished from one another; as might naturally be supposed, the situations and localities which they peculiarly affect are very much influenced by the same circumstances, and the animals necessarily frequent such places as abound most in their proper food. The grazing tribes, for example, such as the *Oxen*, the *Calliopes*, the *Tragelaphs*, &c., are invariably found in lowland forests, prairies, and rich savannahs, where the rank and luxuriant grasses afford a never-failing supply of that coarse unnutritious food which Nature has appointed for their sustenance, and of which they require large quantities to fill their capacious paunches; whilst, on the contrary, the browsing class, the *Sheep*, *Goats*, *Antelopes*, *Gazelles*, &c., are as invariably confined to the arid deserts and karroos, or elevated mountain-chains, which abound in the aromatic and saline herbs, the heaths, salsolas and euphorbias, which they delight to crop, and which communicate to their flesh that musky smell and game flavour that distinguish the venison of the *Goat* from the beef of the *Ox*.

Another consequence of the variety of structure in the organs at present under consideration, is to be noticed in the different nature and properties of the concretions so frequently found in the stomachs of ruminating animals. These are principally of two kinds, Bezoars and Ægagropiles. The latter are common to all descriptions of Ruminants, and are composed merely of the hair which the animal licks from its body, agglutinized by a viscous matter, and rolled into balls and polished by the action of the stomach. Bezoars, on the contrary, are composed of a substance analogous to the tartar which often incrusts the teeth of domestic cattle, arranged in concentric and highly polished layers round a small nucleus of some vegetable matter, such as the seeds or buds of plants, and amalgamated with the aromatic gums so common in hot dry countries. They are found only in the stomachs of Ruminants with ovine or attenuated hairy lips, more especially those which browse on the resinous spicy shrubs of Arabia and Persia, as the different species of *Goats*, *Gazelles*, and *Antelopes*, properly so called, as well as in the *Llamas* of South America; for the grasses which compose the great mass of the food of grazing Ruminants do not appear to contain the principles necessary to the formation of the Bezoar.

Now these generalizations, of such high interest in the history of the animal œconomy, and founded as they are upon philosophical inductions drawn from the necessary relations which subsist between structure and habits, ought by no means to be neglected in the classification of the Ruminants. It is obvious, indeed, that any generic arrangement which disregards characters so influential, can neither be consonant with the principles of sound philosophy nor consistent with the natural affinities of the animal kingdom. A mere artificial system, which does not aim at those high generalizations and inductions, but which is based upon such arbitrary characters as appear best calculated to facilitate the knowledge of specific differences, may indeed pass over them unheeded, as was done up to the time of Illiger, or employ them as mere empirical diagnoses, as has been partially the case since; but the time is fast passing away when a barren catalogue of detached facts, individual differences, and specific resemblances can be dignified with the name of a science. Illiger, it is true, has introduced the consideration of the muzzle among the characters of the genera *Bos*, *Capra*, and *Antilope*; Lichtenstein, De Blainville, and Hamilton Smith have made use of the same character in distinguishing the different subgenera into which they severally divide the artificial genus *Antilope*; but all these naturalists employ it purely in a diagnostic sense, and appear to have formed no distinct conception of its real value as a natural character, or of the influence which it exercises over the habits and œconomy of animal life.

III. Of the Crumens and other Glands.—There are certain pits or sinuses which open externally, especially in different parts of the head of ruminating animals, but of which the functions and uses are as yet but imperfectly understood. The most remarkable, as well as the most common of these, are the suborbital, sometimes called the lachrymal, sinuses, or tear-pits, but which I shall distinguish by the name of *crumens*, first I believe applied to them by Dr. Fleming, and in every respect a preferable term. These are situated at a short distance below the inner canthus of the eye, and received into a deep pit or cavity of the lachrymal bone, which is hollowed out for that purpose. At their bottom is a gland opening into the crumen by a number of small apertures, and secreting a viscous substance of the consistence of ear-wax. In the common *Gazelle* (*Gazella dorcas*) this gland is about the size of a hazel-nut, and has five apertures arranged in a quincunx form, through which, upon pressure, a dark tenacious clammy substance oozes out in threads about the thickness of a common knitting-needle. The external opening of the crumen is of various forms, sometimes large and oblong, as in the *Gazelles* and *Indian Antelope*; sometimes smaller, and of a circular form, as in the *Thar* and other *Capricornes*; sometimes also the gland itself is superficial, without the existence of an actual crumen, as in the *Bubals*; but in all cases, the *Sheep* only excepted, the lips of the crumen are furnished with voluntary muscles, and may be opened and shut at the will of the animal. These organs are developed to a greater or less extent in most *Deer*, and about half the Ruminants hitherto called *Antelopes*. Their functions and uses, as already observed, are still very obscure. At the meeting of the British Association in 1833 I proposed this question for the consideration of naturalists and physiologists; it was answered the year following by Dr. Jacob[1] of Dublin, who considered the crumens as sexual organs, because they are more largely developed and in a state of greater activity in the adult males than in the females and young. To say that they are sexual, however, does not by any means clear up the obscurity which hangs over their functions and uses; for, in the first place, it does not explain why they should be present in some cases and absent in others; nor, secondly, does it show any positive or necessary relation between the crumens and the organs of generation. It is not therefore a logical induction, but a mere hypothesis—plausible enough in some respects, but which does not explain the whole of the facts. Were the crumen a mere sexual organ, intended to carry off from the system those superfluous secretions which at certain periods are directed to the purposes of reproduction, we should naturally expect to find it in opposition to what Dr. Jacob has stated, and what is really the fact—less active in the rutting-season than at any other time, because the secretions which are supposed to excite it are then directed elsewhere; besides, the hypothesis does not at all account for its presence in the *Deer* tribe, where the secretions in question are directed to the reproduction of the horns, and where it is, nevertheless, almost universal, any more than for its absence in the greater number of hollow-horned Ruminants.

These considerations are sufficient to show that its uses are not sufficiently accounted for by calling the crumen a sexual organ; but what its real functions are I am at a loss to determine. Colonel Smith supposes that they may "afford increased facilities in breathing, and greater powers of scent[2];" and their position in the vicinity of the organs of sensation, as well as the use which the animals are often observed to make of them, by protruding and rubbing them against strange substances, particularly when they possess agreeable or aromatic odours, certainly countenances the idea that they may be in some way subservient to the intelligence of the animals. Neither does the presence of the gland at the bottom of the crumen contradict this idea; for the nose, the tongue, the eye, and the ear, all have their appropriate glands which secrete peculiar fluids to lubricate the organ, and keep it fit for the reception of sensorial impressions. Indeed, when these secretions are stopped, from any derangement of the gland, and the organ becomes hard and dry, its acuteness is impaired, or its function entirely ceases, in proportion to the intensity of the derangement. Now the interior of the crumen is lubricated and kept moist by its appropriate secretion, exactly like the Schneiderian membrane; whether it be endowed with sensitive nerves, and have functions in any way similar, are questions for the comparative anatomist and physiologist; but whatever

[1] Report of the British Association for 1834.

[2] Griff. Anim. King., iv. 163.

may be the value of Colonel Smith's supposition, that the crumens are themselves organs of smell,—they certainly have nothing to do with respiration,—they may, and I believe do, contribute to the intelligence of the animals in another way. During a series of experiments which I made upon this subject in the year 1833, I noticed that the *Gazelles* and *Antelopes* in the Society's gardens frequently protruded the crumen, and rubbed its inner surface against the paling and rails of the compartments in which they were confined, seeming to take a pleasure in smelling, and licking it afterwards. A male and female *Gazelle* occupied contiguous compartments; I had them changed, and found that they immediately discovered the viscous deposit, and became restless and agitated; the male *Gazelle* was, some days after, made to change places with an *Indian Antelope*, but neither animal appeared to take the slightest notice, or to be aware of the presence of its predecessor. This, to be sure, is but a single experiment; but it countenances the idea, highly probable in itself, that the deposit which the animals leave behind them, by rubbing the crumens against the shrubs or stones of their desert and mountain habitats—for it is only the inhabitants of such localities that are furnished with these organs, at least among the hollow-horned family—may serve to direct them in their wanderings and migrations, when the storms and fogs incident to such places obscure all visible landmarks. But whatever it may be, the principles of sound philosophy and the great doctrine of design forbid us to entertain the notion that so remarkable an organ has been formed without some special and appropriate function in the animal œconomy: though it is certainly not subservient to the purposes of breathing, as some authors[1] have supposed, it is, nevertheless, too constant in form, and too universally found in animals of the same natural group, to allow of its being omitted among their generic characters.

There is a peculiar modification of the crumens found in the *Duikerbok*, *Philantomba*, and other allied species, which has been generally considered as a distinct organ, though certainly without sufficient reason. There is no actual sac or pit, but the organ appears externally in the form of a long, narrow, superficial stripe of naked black skin, and secretes a thin watery-looking fluid, which oozes out through numerous minute pores, and thickens on exposure to the air. Neither their superficial character nor their situation, however, is sufficient to constitute them different organs. They are equally superficial in the *Gnoo* and *Hartebeest*, though placed in the usual position; and I have myself ascertained that the gland is invariably lodged in the usual hollow of the lachrymal and its contiguous bones, the long naked stripe on the cheek being only a modification of its outlet. M. F. Cuvier[2] and Colonel Smith[3], indeed, report that these maxillary glands sometimes exist simultaneously with the crumens; but this is contradicted by my own observations in one of the cases which they adduce, that, viz., of the *Cambing Outan*, and what I have said above will be sufficient to disprove it in

[1] Col. Smith, in Griff. Anim. King., iv. 163.
[2] Hist. Nat. des. Mam., art. *Cambtan*.
[3] Griff. Anim. King., iv.

others. Being superficial, these glands are not equally under the control of the animals, but I have repeatedly observed them protruding their long slender tongues, and licking off the secretion.

Other sinuses, of equally partial occurrence, but remarkable for their situation, and of which the functions are likewise unknown, occur on the foreheads of the *Muntjacs*. They are situated between the orbits, one on each side, close to the projecting ribs formed by the elongated pedestals which support the horns, and another smaller in the centre of the forehead, and consist of a reduplication of the skin, forming a longitudinal fold, with soft naked parietes, which are moistened by a glandular secretion, and opened or closed at the will of the animal. These glands are found only in the *Muntjacs*, and unless they have relation to the irregular shedding of the horns already noticed in these animals, which is countenanced by their minute development in the hornless females, I cannot form any conjecture as to their use. In the former case they might equally be expected to occur in the *Prickets* of South America, which are said to be subject to the same irregularity in shedding the horns; but I have never myself had an opportunity of examining these *Deer*, and Azara and other authors are silent on the point. At all events it is certain that their function must be different from that of the crumens, since these are very largely developed in the *Muntjacs*.

The membranous sac which opens behind the ear of the *Chamois*, and the large gland which Mr. Hodgson describes in the nose of the *Chiru*, are of too partial occurrence to be made available as generic characters; nor am I aware of the existence of any other glands in the head of ruminating animals. There are, however, two large and deep sacs, situated one on each side of the udder and scrotum in many of the animals heretofore called *Antelopes*, which are of pretty general occurrence, and appear designed to carry off the superabundant secretions which at particular times go to supply the milk and seminal fluids, if indeed they be not analogous to the glands found in the groins of all animals. Their function, however, does not appear to me to exercise sufficient influence over the animal œconomy to entitle them to be considered among the generic characters of a natural classification; and therefore, though I have noticed them among other subsidiary attributes, I have never included them among my generic distinctions. The same observation may be applied to the odoriferous bags attached to the prepuce of the *Musk* and *Antilope gutturosa*, as well as to the subcaudal gland of the *Goats*, which opens immediately at the root of the tail, and secretes a viscous humour that communicates the rank hircine smell so well known in these animals; so that upon the whole the crumens and facial glands are the only organs of this nature which appear entitled to the rank of generic characters. At the same time it must be observed, that even these are of less importance, as principles of classification, than most of the other essential characters which I have employed. The obscurity of this function would alone suffice to depreciate their value as philosophical characters, were it not a fact that the crumens become actually evanescent in genera otherwise perfectly homogeneous and undoubtedly natural; as for instance in *Ovis*, where the *Argali*, the *Mufflon*, and the domestic species still retain these organs, deprived indeed of all power of voluntary motion, and of the secretions which accompany them in their normal form, whilst they are altogether wanting in the *Nahoor* and *Wadan* (*O. tragelaphus*).

IV. Feet and Digital Pores.—The organs of locomotion are the last parts of the animal structure which it is necessary to consider as furnishing characters for generic distinction; yet there is less variety in the mere form of the feet among the *Ruminantia* than in any other equivalent group of Mammals. With the exception of the *Camelidæ*, all these animals have the foot formed on the same model, and differ only in some slight modifications of the hoof, which is always adapted to the nature of the habitat. Mountain Ruminants, for instance, such as the *Goats* and *Capricorns*, have the frog or under part of the foot hollow, and the hoof surrounded by a prominent sharp rim, which, by rapidly catching upon the slightest asperities, gives them a firmer hold of the slippery and precipitous rocks among which they dwell; and the effect is increased by the rigid structure of the pastern and the shortness of the hoofs. The inhabitants of the sandy deserts and swampy savannahs, on the contrary, have broad flat hoofs to prevent them from sinking; whilst those of the open stony plains are chiefly remarkable for the length and springy elasticity of the pastern, the hoof being of an intermediate form between the two extreme varieties just described.

These modifications, however, are scarcely definite enough to be employed in distinguishing genera; but the glands or pores which open between the toes of many Ruminants afford much better characters for this purpose, and bear a very evident relation to the habits and geographical distribution of the animals. These glands are of greater or less extent in different genera, according to the nature of the localities which they frequent; in the *Gazelles*, *Antelopes*, *Bubals*, and *Oryxes*, which inhabit the burning deserts of Africa and Central Asia, they are extremely large, and frequently occupy the whole interspace between the first and second phalanges; in the *Sheep*, *Capricorns*, and *Tragelaphs*, again, which live on the open grassy downs and mountains of a less arid nature, they are of much smaller size; whilst in the *Oxen*, *Calliopes*, &c., which inhabit the moist forests and swamps of tropical regions, or the grassy meadows of temperate climates, they are altogether wanting.

The structure of these organs does not appear to differ from that of the glands already described. They secrete an oily fluid, which keeps the whole foot continually moist and cool, lubricates the hoof, and prevents it from cracking under the influence of a hot tropical sun or parching desert wind; and this remarkable and beautiful instance of design is exemplified in many important cases. The cattle of South Africa, for instance, when travelling over the great Karroo, and long exposed to the parching winds which prevail there, contract a disease, familiarly called the hoof-distemper, brought on entirely by lack of moisture; the foot inflames, the hoof cracks and drops off, and the traveller is often in danger of perishing in the wilderness by the loss of his cattle. Yet the large herds of *Gnoos*, *Gemsboks*, *Hartebeests*, and *Springboks*, which swarm in these very localities, are never known to be thus affected; Nature, in assigning them such dangerous habitats, furnished them with proper preventives; and the boors are so well aware of the circumstance, that I am told they are accustomed to grease the hoofs of their cattle, to preserve them from the effects of an unusually dry season. On the other hand, the disease commonly known as the foot-rot in *Sheep*, and which has been extremely rife during the last autumn, is occasioned by wet swampy pastures; the water enters the pores, inflames them, and stops their secretion, and the foot, deprived of the natural protection which it receives from its oily covering, swells and suppurates; the hoofs rot and drop off, and the animal perishes. Each tribe of Ruminants is thus adapted to its own peculiar habitat, which cannot be arbitrarily or capriciously changed, even by the modifying influences of domestication. We see the same influential characters producing their effects upon the every-day habits of our common cattle. The *Ox* or *Cow*, in a hot summer day, will fly to the pool or river, and remain for hours together immersed in the water; the *Sheep* and *Deer* content themselves with the friendly shade of a spreading tree or overhanging bank, and never willingly wet their feet or enter the water, except by force. Many species of the genus *Bos*, in fact, and more especially the subgenus of *Buffalos*, are nearly as aquatic as the *Tapirs*; and the same may be said of the *Koodoo* and other *Calliopes*; the *Ellipsiprymnus* is even called the *Waterbuck* by South African travellers, and the *Reit* or *Reedbuck* receives its name from the same propensity. All these peculiarities of manners and œconomy will be more fully developed when I come to speak of the different genera in succession. In the meantime I have said enough to show how the character of the digital pores bears upon the important questions of habit and geographical distribution, and to demonstrate their consequent importance as principles of classification. They have not hitherto, at least as far as I am aware, been noticed by any previous zoologist; but I confidently hope that the employment of this and the other influential characters, which it is the object of this first part of my Monograph to explain, will be found to establish a logical, scientific, and natural arrangement among the *Ruminantia*, instead of the prevailing arbitrary and artificial system.

From these considerations, it appears that there are only four modifications of organic structure which can be employed with advantage as generic characters in the natural classification of the hollow-horned Ruminants; that is to say, in a classification which pretends to arrange these animals according to the relations which necessarily subsist between their organization and their habits. These are,—

1st. The sexual character of the horns, as confined to the males, or common to both sexes.

2nd. The form of the upper lip, as attenuated and prehensile, or provided with a heavy callous muzzle.

3rd. The presence or absence of crumens; though this character is neither so absolute nor so influential as the others, and even occasionally varies in the same natural genus; and

4th. The existence or non-existence of interdigital glands or pores.

I exclude altogether from among natural generic characters all consideration of the flexures of the horns, inguinal pores, number of teats, length of tail, elevation of croup and withers, comparative size, beard, dewlap, scopæ, &c., as being entirely void of any assignable influence on the habits and œconomy of the animals; though even these are, generally speaking, constant in the same natural groups, and, as secondary characters, afford satisfactory proofs of the correctness of the principles on which their formation depends. The following are a few *general laws* relating to the most prominent of these characters, which I have deduced from my examination of the species of hollow-horned Ruminants, and which in doubtful cases may serve as a guide to probable conjecture; but they are only general, and I beg expressly to warn observers against mistaking them for absolute facts.

1. All hollow-horned Ruminants with *scopæ* have two teats, except the *Orabie* and *Prongbuck.*
2. All with *scopæ* have hairy attenuated lips, except the *Orabie.*
3. All with *scopæ* have crumens, except the *Prongbuck* and *Aoudad* (*Ovis tragelaphus*).
4. All with four teats have naked muzzles, except a few *Goats* and *Antelopes proper.*
5. All with naked muzzles have four teats, except the species of the genus *Bubalus.*
6. All with two teats have hairy attenuated lips, except the *Bubals.*
7. All with hairy attenuated lips have two teats, except the species mentioned in Rule 4.
8. All with superficial crumens have naked *muzzles.*
9. All with superficial crumens are without *scopæ.*
10. All without crumens are equally without *scopæ,* except the *Prongbuck* and *Aoudad.*
11. All with *scopæ* have the horns confined to the male sex, except the *Gazelles* and *Aoudad.*
12. All with horns in both sexes, muzzles, and no crumens, have four teats.
13. All without crumens have four teats, except the typical species of *Capræ.*
14. All with muzzles and horns in the male sex only have four teats.
15. All with hairy attenuated lips have digital pores, except the *Goats.*
16. All with hairy attenuated lips have horns in both sexes, except the *Antelopes proper.*

To exemplify the utility of these rules in certain cases of doubt, let us take the following examples. Colonel Hamilton Smith describes two species of *Antelopes* under the names of *A. forfex* and *A. adenota,* to which he attributes the following characters: horns confined to the male sex, naked muzzles, crumens, scopæ, and two teats. Now this is a combination of characters which exists in no known species of Ruminant. In the first place there is no species with *scopæ* which has a naked muzzle, except the *Orabie* (*A. scoparia*), and it has four teats (Rules 1 and 2); 2ndly, no species with a naked muzzle has two teats, except those of the genus *Bubalus*, and they have horns in both sexes (Rule 5); and lastly, all, without exception, which have muzzles and horns in the male sex only, have four teats (Rule 14). I conclude therefore that there are very strong probabilities against the existence of any animal with such a combination of characters, and that Colonel Smith was mistaken in some of his observations, possibly respecting the number of teats, which indeed he only reports from the examination of a mounted specimen. Again, the same zoologist describes, under the name of *A. quadriscopæ*, a species with muzzle, scopæ, and superficial crumens—he gives it sacculated crumens of the ordinary kind besides, but with these we have nothing to do at present —a combination which is rendered highly improbable by Rules 2 and 9, and consequently the species cannot be considered authentic, but must remain doubtful till further observation. In all similar cases these rules will enable the inquirer to form a tolerably correct estimate of the value of observations or descriptions to which any kind of doubt attaches, or even to induce more caution and correctness in making his own observations, as any disagreement would naturally lead him to suspect some error, and consequently to repeat his examination; for though, as I have already observed, their authority is by no means to be considered absolute, they are nevertheless entitled to very considerable weight, as being deduced from the personal examination of above eighty species of hollow-horned Ruminants.

To exemplify the application of the principles developed in the foregoing paper, and the precision and certainty which they substitute for the vague and indefinite characters hitherto employed, I here subjoin the definitions of the three old genera, *Bos*, *Ovis*, and *Capra*; and it will be observed, that, besides the mere *logical* advantages just mentioned, they have the *philosophical* quality of combining those relations of œconomy to structure, which enable the zoologist to *infer* the habits of the animals from the definition of the group, and which form the very essence of a natural classification.

Bos: *cornua in utroque sexu; rostrum rhinario instructum; glandulæ interdigitales nullæ; sinus lachrymales nulli.*

Ovis: *cornua in utroque sexu; rostrum chilomate instructum; glandulæ interdigitales distinctæ; sinus lachrymales aut immobiles aut nulli.*

Capra: *cornua in utroque sexu; rostrum chilomate instructum; glandulæ interdigitales nullæ; sinus lachrymales nulli.*

These, and the definitions of the new genera, with the descriptions and synonyms of the species, will form the subject of the remaining parts of this Monograph.

V. *Description of* Australian Fish. *By* John Richardson, *M.D., F.R.S., &c., Inspector of Naval Hospitals, Haslar.*

Communicated June 25, 1839, March 10, 1840, and March 9, 1841.

The fish described in the following pages were mostly collected at Port Arthur, in Van Diemen's Land, by Deputy Assistant Commissary General F. J. Lempriere, Esq., and forwarded to the author by His Excellency Sir John Franklin, K.C.H., Lieutenant-Governor of the colony. The collection was sent to England as opportunity offered, in three portions, the first being despatched from Port Arthur in October 1837, and the second, a year afterwards. The specimens were carefully put up in casks, in spirits, and, considering the length of the voyage, arrived in tolerably good order. The colours, it is true, had in most instances faded, or altogether disappeared, but only a few of the fattest and bulkiest of the fish were so much injured as not to admit of the essential parts of their structure being determined. Mr. Lempriere had numbered the specimens in reference to a list which he sent of the local names, with their colours when recent; but the greater part of the labels having been rubbed off, it is only in a few instances that his very useful remarks could be confidently referred to the proper subjects. A copy of his list is subjoined, with the addition of the specific names of the fish to which they are supposed to allude.

Detailed descriptions of fifteen of the species, and the characters of two new genera, *Nemadactylus* and *Latris*, were read before the Society on the 25th of June, 1839, and a second communication, read on the 10th of March, 1840, gave an account of an equal number of species. This last paper contained also the external characters of *Hoplegnathus*, a new genus, founded on a single dried specimen presented to Haslar Museum by the surgeon of a convict ship, but unaccompanied by any notice of the place of its capture, though it is supposed that he procured it at Hobart Town; and of a *Syngnathus*, belonging to the same museum, also reported to be from the southern seas, but the precise habitat of this fish is also unknown. A third paper, read on the 9th of March, 1841, contained a description of a freshwater eel, of Mr. Lempriere's collection; some additional remarks on the *Narcine*, described in the second paper; the characters of a *Cheilodactylus* from Western Australia, brought home by Mr. Gould, but which had been previously found by Parkinson on the east coast; and a description of an *Ostracion*, also of Australian origin, belonging to the museum at Fort Pitt.

These three papers are here incorporated, under the sanction of the Council; and the author, having recently received the third part of Mr. Lempriere's collection, preserved in brine, and also had an opportunity of consulting the drawings of Australian fish made on Cook's first and second voyages by Parkinson and Forster, now in the Banksian library, has added a few references and remarks to the original descriptions of some of the species. The specimens are deposited in the museum of the Royal Naval Hospital at Haslar, and the figures illustrative of the first paper were drawn by the late Mr. Charles Curtis, the intimation of whose name is a sufficient warrant for their fidelity. The remaining figures were executed by Mr. Mitchell, an artist residing at Portsmouth, and are also accurate.

The Australian fish are imperfectly known, and we may infer that the species are very numerous, since the bulk of every ichthyologist's collection who has visited those seas has been formed of undescribed fish. Their forms are in general unlike those which prevail in similar latitudes of the northern hemisphere, and Cuvier has found it necessary to range many of those known to him at the ends of his larger families, to which they form, as it were, supplementary or aberrant groups. Of one of these sub-families, which contains two genera (*Pelates* and *Helotes*), almost exclusively Australian, he has said, "*S'il existe un groupe de poissons qui semble fait pour désespérer les naturalistes, en montrant à quel point la nature se rit de leurs combinaisons caractéristiques, c'est celui dont nous traitons dans cet article, &c.*" Mr. Lempriere's collection enables us to add to the list two genera, fully as remarkable as the above for the combinations they present of the characters of several families; and, what is not less interesting, it also makes us acquainted with several forms, which differ only in minor specific characters from their congeners in the northern seas, viz. *Scorpæna*, *Sebastes*, *Lepidoleprus*, and *Anguilla*. We also discover from it that Van Diemen's Land possesses an electric *Ray* different from that of the Cape.

Haslar Hospital, 16th March, 1842.

"*List of Fish caught at Port Arthur, Van Diemen's Land, October* 1837.

No. 1. Gurnett. Two specimens, of the common size: taken in salt water: colour bright red, with brown spots. Good for the table. (*Sebastes maculatus.*)

2. Parrot fish. Salt water. One specimen, of the common size; not so brilliant as other individuals: flesh coarse, and to some disagreeable, but not unwholesome. (*Labrus.*)

3. Shad or Red Perch. One specimen, of the usual size: taken in salt water: reddish-brown when first caught: the colours brilliant, especially a light blue stripe near the eye, and running along the sides. Good for the table. (*Serranus rasor.*)

4. Perch. Salt water. One specimen; but the fish is sometimes half as large again: has a bright silvery hue, with dark spots. Is much admired for the table. (*Cheilodactylus carponemus.*)

5. Soldier-fish. Salt water. One specimen, of small size: has a lively flesh-colour. Is good for the table. (*Scorpæna militaris.*)

6. Bull-head. Six specimens. Salt water. Hides under stones: colour dark brown, with black spots. Is considered to be unwholesome.

7. Trout. Fresh water. Six specimens, of the common size: colour dark olive, with red spots; but some, of a darker colour, will weigh nine ounces. Excellent for the table. (*Galaxias.*)

8. No local name. One specimen, taken in salt water: colour red, with spots. The only size I have seen. It is remarkable for its crest and seal-like pectoral fins: it is not known whether it be edible or not. There is an imperfect figure of the species in Dr. Ross's 'Annual' for 1835. (*Cheironectes politus.*)

9. Trout. One specimen. Fresh water. Differing slightly from No. 7.

10. Mullet. Salt water. Three specimens, of the common size. Excellent for the table. (*Dajaus Diemensis*)

11. Sea Pig. Salt water. One specimen, of the common size: sometimes handsomely striped with blue and yellow. (*Ostracion.*)

12. No name. Salt water. Two specimens. A rare fish, only four having been caught in five years. Not eaten. Colour brown; every scale serrated. Sent the skin of one to W. Swainson, Esq. in 1835. (*Lepidoleprus australis.*)

13. Salmon. Salt water. Common size: back dark blue; belly silvery, with yellow and red spots. Much sought after for the table, and caught in great shoals with the seine. (*Centropristes salar.*)

14. Nourse's eggs. The eggs of a species of shark.

15. Silver fish. Salt water. One specimen, full size: resembles the salmon, but is thicker, and without spots. It is supposed that they migrate, as they are taken only at long intervals: eleven hundred have been caught by the seine in one night. They are equal to the Trumpeter in flavour and richness.

16. Lobster. Fresh water. Four specimens, of the common size, but they are known to reach the length of nine inches: colour almost black, but boil red: rather strong in flavour. (*Cray-fish.*)

17. No name. Salt water: caught swimming on the surface.

18. Sea Horse. Salt water. One specimen. There are several varieties here, one of them distinguished by its nine tentacula. (*Syngnathus.*)

19. Porcupine Fish. Salt water. Two specimens. When first caught the form of this fish is spherical, but it afterwards becomes elongated. (*Diodon nicthemerus*, Cuv.)

20. Toad Fish. Salt water. Specimen common size. Taken in shallows off sandy beaches. Dark brown spots. The natives dread this fish, and several colonists have died from eating it. (*Apistes marmoratus.*)

21. Kelp Fish. Salt water. Four specimens, of the common size. When fresh it

is beautifully striped with red and blue on the sides of the head. Is a very good fish for the table. (*Odax algensis.*)

22. Leather Jacket. Salt water. Four specimens. This fish is ornamented on the sides with beautiful blue and yellow stripes, and on the belly are blue spots. Common size. (*Aleuteres paragaudatus*, nob.)

23. Soldier Crab. Three specimens. Constantly at war with each other, and fighting with their claws.

24. Parrot Fish. One specimen. A variety of No. 2, with very broad scales. (*Labrus.*)

25. Leather Jacket. Salt water. Two specimens. A larger species than No. 22. When skinned, good for the table. The spike on the head makes a wound that is difficult to heal. Colour grey: specimen of common size. (*Aleuteres maculosus*?)

26. Flat Head. Salt water. Two specimens, of common size. The fish rarely reaches two feet in length. Taken on a sandy bottom. It is good for the table. The back is brown and spotted; the belly white. (*Platycephalus Tasmanius.*)

27. Parrot Fish. Salt water. One specimen. This fish, even after death, exhibits almost all the colours of the rainbow, and it deserves its name from the brilliancy of the hues of its skin. It is good for the table. (*Labrus laticlavius.*)

28. Kelp Fish. Salt water. A variety of No. 21. This species has a dark stripe, which No. 21. has not. (*Odax balteatus*, Cuv.?)

29. Sea Horse. One specimen, a variety of No. 18, without the tentacula. (*Syngnathus.*)

30. Tail of the Sting Ray. The fish sometimes weighs from two to three cwt. When attacked it lashes its tail violently, and its spine makes a wound which is dangerous, painful, and difficult to heal. (*Trygon.*)

31. Rock Cod. (*Gadus*?) Salt water. One specimen. Changes colour in dying. Good for the table. F. J. Lempriere.

The specimens contained in the second and third casks were also numbered, but no list accompanied either of them.

I have derived some assistance from a collection of drawings of Port Arthur fish formed by Dr. Lhotsky. The artist, a convict (employed by Dr. Lhotsky), took pains, I am assured, to count the rays, &c., but being unacquainted with the characters relied upon by ichthyologists, his figures are defective in not giving the exact forms of the opercular pieces, their serratures, the distribution of the scales on the head, &c. I have not, therefore, been able confidently to assign some of them to their proper species.

One of the best executed figures is that of a *Capros*, of which I have received no specimens. The general form is not very dissimilar to that of the *Zeus faber*, but the first dorsal is shorter and higher; the mouth is still more protractile, and there are no tubercles of any kind represented on any part of the fish. The fins and several parts about the head and gills are rose-coloured : the body is pale, with a strong golden lustre on the small scales, which cover also the cheek and three patches on the supra-scapular bone. The figure shows the rays as follows :—V. 1|5 ; D. 7 — 18 ; A. 2 — 17 ; C. 14. The ventrals are farther back than in the common *Dory* or Mediterranean *Capros*, being under the middle of the pectorals. All the rays of the second dorsal and anal are represented as simple. Voyagers to New Zealand mention *Dorys* as common on that coast, but none of the naturalists who have visited the Australian seas speak of the *Boar-fish*. We name the species *Capros Australis*.

SERRANUS RASOR, *Tasmanian Barber*.—*Serranus rasor*, Proceedings of Zoological Society, June 25, 1839, p. 95.

Tab. IV. Fig. 1.

Serr. maxillis valdè squamosis ; ramulis radiorum pectoralium apices lanceolatos formantibus ; pinnis omnibus præter ventrales squamosis ; radiis aculeatis pinnæ dorsi subæqualibus ; fasciâ oculum cingenti cæruleâ per lineam lateralem productâ.

Radii :—Br. 7 — 7 ; P. 13 ; V. 1|5 ; D. 10|21 ; A. 3|9 ; C. $15\frac{1}{4}$.

The serrature of the preoperculum is the most obvious and general character by which the very numerous *Serrani* are connected with each other. A considerable proportion of the species have the jaws entirely scaleless ; another, and a still larger division ("*les Merous*"), have very small scales on the lower jaw only ; and the third and smallest group have the labials, as well as the lower jaw, well protected by scales. These variations in the extension of the scales on the jaws are not inseparably connected with modifications in the structure of more essential parts, so as to furnish characters for generic or subgeneric groups, but they are used by Cuvier merely as a convenient means for subdividing a very extensive genus. He therefore rejects Bloch's genus *Anthias*, which corresponds to the small division, having strong scales on the labials, but retains the group as an artificial subdivision, under the designation of "*les Barbiers*."

The Van Diemen's Land fish, which is described below, is one of the "Barbers," a fact which the specific appellation *rasor* is intended to indicate ; the more classical word *tonsor* having been previously appropriated to another species.

Six Barbers are described in the 'Histoire des Poissons,'—one from the Mediterranean, another from the Mauritius, and the rest from the Caribbean or Brazilian seas. Three of them have one of the dorsal rays and the caudal lobes prolonged ; the three others have the spines of the dorsal more nearly even. The Tasmanian Barber resembles the latter in this respect, but is readily distinguished from them and from all other *Serrani* of which we have seen figures by the peculiar form of its pectoral rays, as well as by other characters, such as the large number of articulated rays in the dorsal.

Mr. Lempriere states that it is known locally as the "red perch or shad," and that it is considered to be a good fish for the table.

Form oval, the curve of the back from the snout to the end of the dorsal being elliptical, and rather more regular than that of the belly, which is flattened in at the ventrals. The greatest depth of the body is midway between the ventrals and anal, and is equal to half the length from the snout to the end of the dorsal, or to one-third of the whole length, measured to the tips of the caudal lobes. The height of the naked part of the tail is equal to one-third of that of the body, and its thickness to one half of its own height. The body is thickest on a line with the pectoral fins, which are attached low down; and its transverse measurement is considerably less than half the height. The belly is full and rounded: the back thins off with less lateral convexity, and is somewhat acute on the ridge.

The head appears short, because of the great descent of the arched profile beneath the summit of the dorsal curve; but it measures to the tip of the gill-cover nearly one-third of the length of the fish, excluding the caudal fin. The end of the snout is on a line with the tip of the gill-cover, and when the mouth is closed the lower jaw inclines upwards to within thirty degrees of being vertical. The top of the head is very convex transversely; the distance between the eyes is equal to a diameter and a half of the orbit; the breadth of the snout to one diameter; and posteriorly the head and nape thins off, so that the breadth between the supra-scapulars is less than between the eyes.

The eye small, and exactly round, is situated about half its diameter beneath the profile of the forehead, six times as far above the isthmus of the gill-membranes, one diameter behind the mouth, and two anterior to the gill-opening. It is surrounded by a scaleless bony circle, which is lined by a narrow, thick, smooth, immoveable membranous edging or eyelid, whose inferior half is finely crenated. The broadest part of the circle is formed by the anterior infra-orbitar, whose margin is curved and slightly undulated, but not serrated. The posterior infra-orbitars are much narrower, and the orbitar margin of the frontal narrower still. All are pitted or furrowed, and the infra-orbitars are perforated by many pores. The nostrils, situated in a smooth stripe of skin near the anterior angle of the eye, are small, and the anterior opening has a slightly raised tubular margin.

The mouth is rather small, its commissure not reaching backwards beyond the nostrils. When it is extended, the lower jaw is depressed below the horizontal line; the intermaxillaries are slightly protruded, and the orifice thrown forwards. The labial is broad and truncated below, having a triangular form; its articulation alone glides under the infra-orbitar, its wide lower extremity passing beyond the tip of the intermaxillary, so as to overlie the limb of the lower jaw when the mouth is shut, and touch the circumference of the orifice when it is open.

Teeth.—Most of the dental surface on the intermaxillaries and lower jaw is armed with villiform teeth[1]; but the inner rows at the symphyses, and also on the limbs of the

[1] I use the term recently introduced by Mr. Owen to express the French "*en velours*."

jaws, though but slightly longer, are curved. A few very short, conical and bluntish, but scarcely larger canine teeth stand among the others, near the symphyses of both jaws—those in the anterior row pointing directly forwards, the posterior ones backwards. There is a transverse belt of teeth in close-cut pile (*en velours ras*) on the chevron of the vomer, and a short longitudinal one at right angles to it on each palate bone. The delicate and hair-like upper and lower pharyngeal teeth are also in villiform patches. Tongue smooth.

Gill-covers.—The upper limb of the preoperculum and the posterior half of its lower limb are finely serrated, the teeth being a little coarser at the angle, which is moderately rounded off. The scaly integuments are continuous with the cheek, and entirely conceal the bony structure of the preoperculum; but in the skeleton an elevated ridge is seen pervading both limbs, and their thin posterior borders are transversely fluted and undulated. The edges of the interoperculum and suboperculum are slightly curved, and their posterior halves finely serrated. The operculum terminates in three short, flat, delicate triangular teeth, so fragile that they are seldom all entire. The middle one is the largest; the upper one forms the angular point between the upper and posterior margins of the bone, and is inconspicuous in the recent fish. The cartilaginous extremity of the suboperculum projects beyond these spines, and forms the triangular tip of the gill-cover.

The supra-scapular bone is mostly concealed by the ordinary scales, but in the skeleton it is deeply grooved, the groove forming a notch on its posterior edge, corresponding to the commencement of the lateral line. The rest of the bones of the humeral chain are without spines or serratures, and the scaleless margin of the gill-opening is narrow. The soft axilla of the pectoral is also of small extent, and there is no visible bony plate there.

Scales.—The whole head is scaly, with the exception of the lips, infra-orbitars, a narrow circle round the eye, the soft stripe perforated by the nostrils, and the membranous edges and folds of the gill-covers and jaws. On the forehead and snout the scales are small and very densely tiled. They are larger on the cheeks, gill-covers and maxillaries, smaller again on the lower jaw; and the membrane connecting the limbs of that bone is protected by a thick scaly band, which forks posteriorly, and crosses three of the lower branchiostegous rays, permitting much smooth soft membrane to appear when the jaws and gill-flaps are extended; but when they are shut up, presenting nothing but scaly surface. The scales of the body are largest anteriorly and near the lateral line, smaller towards the contour of the back and belly, still more so before the pectoral and ventral fins, and smallest of all on the fins themselves. The scales in general are square, except that the uncovered edge forms the quadrant of a circle. The base is marked by from eight to fifteen fan-like streaks; the surface is reticulated, the reticulations being distinct only near the exterior margin, which is regularly ciliated by a series of slender, straight, acute teeth. On the lateral line the scales are still more nearly square, the exterior margin being almost straight. The tube of these scales is short, wide, depressed, and confined to the centre, the anterior or basal opening being on the upper side, and the posterior one beneath. There are twenty-three rows of scales in a vertical line behind the pectorals, of which four are above and eighteen below the lateral line, on which there are fifty-four scales, exclusive of a few small ones on the caudal. The lateral line is boldly arched, the curve diminishing posteriorly, and changing to a straight line in its course through the tail.

Rays.—The pectoral is large, with an oval outline, and when turned back reaches to the commencement of the anal. All its rays are branched, and the branches are so disposed towards their ends as to form a flat lanceolate tip to each ray. The base of the fin is protected by an encroachment of the scaly integument, and a tapering row of very fine scales runs up between each pair of rays for half the length of the fin. The ventrals, placed exactly under the pectorals, are rather pointed. The spine is one-third shorter than the soft rays, whose tips reach within half their own length of the anus. The dorsal, commencing exactly above the pectorals and tip of the gill-cover, is supported anteriorly by ten spines, which, with the exception of the two foremost, are all of the same length. The soft portion of the fin, equal in length to the spinous part, is somewhat higher, and its outline is slightly arched, the intermediate rays being rather longer than the extreme ones. The membrane, to the extent of two-thirds of the height of the spinous rays, and one-third of that of the soft ones, is densely covered with small scales. Behind the tip of each spine there is a triangular portion of smooth membrane, which, when the fin is laid back, falls within the looser scaly integument, and, together with the spines which lie alternately a little to the right and left, is wholly concealed. Narrow bands of scales run between the soft rays, nearly to the edge of the membrane. The spines of the anal are short and moderately stout; but the soft rays, which are more than twice the length of the posterior and longest spine, are longer than the soft rays of the dorsal. The outline of the fin is much arched, and the naked space between it and the caudal is considerably greater than that behind the dorsal. The fin commences opposite to the seventh soft dorsal ray, and terminates opposite the eighteenth. It has a scaly base, and prolonged stripes of scales between the rays like the soft dorsal. The caudal fin has a crescentic termination with a scaly base and tapering scaly fillets running between the rays nearly to their ends.

Anatomy.—Exterior row of rakers slender, subulate, and about four lines long; the others shorter, obtuse, those of the inner row on each arch being considerably shorter than the outer ones; they are all bristled with minute teeth.

The stomach descends from the gullet for an inch and a half, gradually widening until it measures an inch across; it then contracts suddenly, to form the much narrower pyloric branch which thus issues from the fundus of the descending portion. The pyloric branch is above an inch long, and has a saccular dilatation on its inferior side. The inner coat of the descending branch is pervaded by about twenty fringed or papillary ridges, pale at their commencement in the gullet, but firmer and of a browner hue in their inferior halves, and thinning off at the contracted fundus. The saccular appendage of the pyloric branch has the inner coat disposed in strong curved folds, but the direct tube is formed of smooth delicate membranes. Though the pylorus is much contracted, no distinct valvular apparatus was detected there. Immediately below it six short slender cæca are attached to a dilated part of the gut. Inferiorly the intestine is very slender and delicate. The air-bladder appeared to be round, without processes, but it was too much injured to permit its form to be precisely ascertained.

Vertebræ 26 : the four first are destitute of transverse processes, which exist in the six following ones. In the ninth, tenth and eleventh, the processes are connected near their origin by a transverse bridge of bone, forming a canal for the vessels. In the twelfth vertebra the processes diverge much less than in the preceding ones, and have a more extensive bony union at their base. It is to this vertebra that the point of the long and strong interspinous bone supporting the two first spines of the anal is applied. The succeeding caudal vertebræ have their elongated inferior processes simple, and merely perforated at the base for the passage of vessels.

Dimensions.

	Inches.	Lines.
Total length to tips of caudal lobes (jaws retracted)	10	6
Length from tip of snout to base of caudal	8	6
Length from tip of snout to end of dorsal	7	4
Length from tip of snout to beginning of dorsal	2	8
Length from tip of snout to tip of gill-cover	2	9
Length from tip of snout to end of anal	7	1
Length from tip of under jaw depressed to ditto	7	6
Length from tip of under jaw to anus	5	10
Length from tip of under jaw to ventrals	3	6
Length of pectorals	2	9½
Length of dorsal	5	0
Length of anal	1	5
Length of ventrals	1	9
Length of caudal lobes	2	4
Depth of caudal fork	0	9
Length of naked space between anal and caudal	1	5
Length of naked space between dorsal and caudal	1	2
Height of body at the pectorals	3	4
Diameter of ditto (thickness)	1	6
Breadth of head at upper edge of the orbits	0	9½
Diameter of orbit	0	5
Height of fifth spine of dorsal	0	9¾

	Inches.	Lines.
Length of descending branch of stomach from gullet	1	8
Length of pyloric branch	1	4
Length of gut	15	0

Centropristes salar, *Salmoid Centropristes.—Centropristes salar*, Zool. Proceed., June 25, 1839.

Centr. operculo suboperculoque squamosis ; interoperculo seminudo ; preoperculo subdenticulato.—Radii. Br. 7 — 7 ; P. 16 ; D. 9|16 ; V. 1|5 ; A. 3|10 ; C. $17\frac{3}{3}$.

Our single specimen of this fish is noted by Mr. Lempriere as being of the usual size of the species, and having, when recent, a dark blue back and silvery belly, with scattered spots of yellow and red. It is caught with the seine in great numbers, and is much prized as an article of food. None of the original colours are now traceable in the specimen, except the blue tint above the lateral line, and the silvery lustre of the scales, which is considerable.

Form.—The curvature of the back is rather greater than that of the belly; the length of the head equals the depth of the body at the fore part of the dorsal, or one-fourth of the total length, caudal included, and somewhat exceeds twice the greatest thickness of the body. There are five rows of scales on the operculum, the upper row containing three scales and the lower one six: the border of the bone overlapping the suboperculum is naked. There is a single row of six scales on the suboperculum, and one of ten or twelve on the interoperculum, remote from its margin and diminishing rapidly in size as they approach the lower jaw. The cheek is entirely covered with scales from the border of the orbit to the ridge of the preoperculum, there being five rows beneath the eye and four behind it: the posterior, broad, crescent-shaped limb of the preoperculum is covered with smooth soft skin, marked with vein-like ramifications, which requires to be removed to permit the finely-toothed margin and furrowed surface of the bone to be seen. The minute serratures do not go higher than the rounded angle of the bone, the ascending limb being nearly smooth. There is a single row of small scales on the labials, the three lower scales being larger than the five succeeding ones.

In the 'Histoire des Poissons' *Centropristes truttaceus* is said to have merely some scales on the operculum, and none whatever on the suboperculum and interoperculum. It has also eighteen soft rays in the dorsal, only nine in the anal, and but twelve in the pectoral, yet in all other respects that description corresponds so minutely with the specimen which we have named *C. salar*, that one might be tempted to consider it as the same species, if the example sent to the authors of the work in question could be supposed to have been so much injured as to have lost many of the scales of its gill-cover; but as nothing is hinted to that effect, the only alternative is to consider the one from Port Arthur as a new species. A reference to the subjoined table of dimensions will show how closely *C. salar* agrees with *truttaceus* in the relative proportions of its orbits and other parts. The form of the scales is the same in both; but *salar* has rather fewer on the lateral line, which contains only about fifty-three, while they are said to amount to nearly sixty in *truttaceus*. *Centropristes salar* seems to form a connecting link between the *truttaceus* and *Georgianus*[1] of the 'Histoire des Poissons.' All three have feebly armed gill-covers and grooves for the reception of the dorsal and anal fins, which give them a mænoid aspect.

The Banksian Library contains four figures strongly resembling this species, executed on the coast of New Zealand on Cook's first and second voyages, viz. No. 67, by Parkinson, entitled '*Sciæna mulloides*,' with the adjunct '*sapidissimus*,' evidently referring to its excellence as an edible fish: the specimen was taken at Opooragi. No. 68, by the same artist, is a similar figure, made in Queen Charlotte's Sound, and has the native name of 'Hetrawai' written on it. These figures represent the back as bluish, with round spots equally distributed above the lateral line. Solander's MSS. account of a fish captured in Tegadoo Bay, lat. 38½° S., is evidently considered by him to be the same species, as it has the epithet '*Mulloides sapidissimus*' prefixed to it. His description, which is a long one, mentions villiform teeth on the jaws, roof of the mouth, and fauces, and contains the following remark respecting the gill-covers: "*Branchiarum opercula arctè clausa. Lamina anterior, et postica superior squamosæ, sed squamæ cute gelatinosâ tectæ, omnes integræ. Radii*:—Br. 7 — 7; P. 16; D. 9|16; A. 3|10; V. 1|5; C. 20." The first and second dorsal spines are stated to be '*brevissimi*,' and it may therefore be concluded, that though the figures exhibit only eight spinous rays, that the first was not conspicuous enough in the recent fish to be represented by the artist. In the number of rays the description corresponds exactly with our *salar*; but in the want of scales on the under opercular pieces (implied by their not being mentioned) it agrees with *trutta*, which in this respect differs from all the other *Centropristes* described in the 'Histoire des Poissons,' including *C. Georgianus*.

Number 210, by G. Forster, inscribed '*Sciæna trutta*,' and also '*Mulloides sapidissima*,' the latter term being possibly intended as a reference to Parkinson's prior figure, has small and rather crowded oblong spots above the lateral line: the dorsal exhibits only eight spinous rays. No. 211, also by G. Forster, is marked '*Sciæna sapidissima*' and '*Mulloides β*,' and was drawn in Queen Charlotte's Sound. It differs from 210 in the spots being fewer and larger, and spreading below the lateral line: the scales extend farther over the cheek. It would appear that the Forsters, with the fresh specimens before them, considered this to be at least a well-marked variety, if not a distinct species; and it is but fair to conclude that Solander observed some differences in the originals of Nos. 67

[1] Considered as the type of the genus *Arripis* by Mr. Jenyns in Part IV. of the 'Zoology of the Beagle,' and differing from *Salar trutta*, &c. in the scales wanting the usual fan-like streaks on their basal halves.

and 68, or he would not have had two figures done at such a short interval of time ; but the details are not made out with sufficient clearness to enable us to judge correctly in the matter, or whether or not they may all safely be referred to *C. truttaceus*. In the 'Histoire des Poissons' reference is made only to a single figure of Forster's.

The intestines of *Centropristes salar* agree with the account given of those of *truttaceus*. The pharyngeal teeth are villiform, the lower ones, covering a long narrow dental surface of the figure of an arrow-head. The rakers of the outer row are long, slender, stiff and acute, ciliated on the interior edge, and smooth externally ; the others are mere ciliated tubercles. There are twenty-five vertebræ : the eighth and ninth have a bridge of bone connecting their transverse processes, and thus enclosing round openings for the passage of vessels ; the eleventh, which is perhaps the first caudal one, has, like all the succeeding ones, a descending tapering spinous process.

Dimensions.

	Inches.	Lines.
Length from intermaxillary symphysis to upper tip of caudal	11	6
Length from ditto to end of central rays	10	4
Length from ditto to end of scales on caudal	10	0
Length from ditto to end of anal	7	10
Length from ditto to end of dorsal	7	10
Length from ditto to beginning of anal	6	8
Length from ditto to anus	6	3½
Length from ditto to beginning of dorsal	3	7½
Length from ditto to tip of gill-flap	2	9
Length from ditto to centre of orbit	0	11½
Length of diameter of orbit	0	5
Length of pectorals	1	6
Length of ventrals	1	6
Length of spinous part of dorsal	1	9
Length of soft ditto ditto	3	0
Height of fourth dorsal spine	1	4
Height of ninth ditto	0	7½
Height of soft rays of dorsal	0	9
Height of soft rays of anal	1	0
Height of body at ventrals	2	8
Thickness of body	1	3
Depth of caudal fork	1	0
Length of descending branch of stomach and œsophagus	2	8
Length of pyloric branch of stomach	0	6
Length of 'cul de sac' of stomach	1	8

	Inches.	Lines.
Diameter of stomach	0	7
Diameter of pyloric branch at its origin	0	$2\frac{1}{4}$
Diameter of ditto at its termination in the gut	0	$1\frac{1}{2}$

Aplodactylus arctidens, *Tasmanian Aplodactylus.—Ap. arctidens*, Zool. Proceed., June 25, 1839.

Ap. dentibus tricuspidatis, superioribus in serie octuplici, inferioribus in serie quintuplici ordinatis; cæcis pylori quatuor.

Radii.—Br. 6 — 6; P. 9 et VI.; V. 1|5; D. 16|—1|17; A. 3|8; C. $16\frac{5}{5}$.

The labels which had been attached to the two specimens of this fish in the collection had dropped off, so that Mr. Lempriere's list gives us no certain information of its habits; but it is evidently a littoral fish, the whole of its intestines being filled with large pieces of a thin membranous sea-weed, resembling or identical with *Ulva umbilicalis*, mixed with some balls of confervæ, and also a few shells with the animals in them undigested. A fleshy substance, like the stem of a sea-anemone (*Actinia*), was found mixed with the weed in the rectum.

The *Aplodactylus arctidens* is a second species of the genus, the previously known one (*punctatus*) being an inhabitant of the seas of Chili. It resembles the latter very closely in external form, except that the ventral and anal fins are much smaller, the pectoral ones proportionally larger, and the caudal nearly even at the end. The dentition also differs in the interior rows on both jaws being formed like the exterior ones, though much smaller[1]. The teeth are narrow, thin, flexible, and festooned at their summit into three lobes, the lateral lobes being shortest and smallest. They form eight or nine densely crowded rows on the upper jaw, and about seven on the lower one, so graduated as to render the dental surface concave. The teeth of the interior row, though scarcely visible through the gum, are shaped just like the others: all are a little curved backwards. There is a small patch of fine villiform teeth on the chevron of the vomer, and a minute corner of the patch extends on each side to the palate bone. The cheek, operculum and suboperculum are protected by small scales, as in *punctatus*; but there is a broad, naked, posterior margin to the operculum, including a nearly equal breadth of bone and membrane: the limbs of the preoperculum, the interoperculum, anterior orbitar, circumference of the eye and the whole top of the head are naked. The scales of the cheek run up towards the supra-scapular, and there is a small scattered patch of scales on that bone. A narrow smooth groove separates a scaly fillet, which covers the base of the dorsal from the integuments of the back.

[1] The following account of the teeth of *Aplodactylus punctatus* is given in the 'Histoire des Poissons':—"*Les dents sont disposées sur trois rangées à la machoire supérieure et sur deux à l'inférieure; elles sont aplaties et ont leur bords arrondis et dentelés en petits festons; elles sont très semblables à celles des Crénidens; on en compte quatorze de chaque côte à la machoire supérieure et treize à l'inférieure. Derrière ces rangées antérieures il y a des petites dents grenues sur une band étroite à chaque machoire et sur le chevron du vomer. Les palatins n'en ont point.*"

The intestines are capacious. The stomach is large and bends upon itself, forming a small 'cul de sac' at the elbow: the somewhat contracted pylorus is muscular and glandular; beneath it *four* short cæca enter the gut, opposite to each other. The convolutions of the intestine are involved in a vascular mesentery. The membranes of the fish generally are strong and tough; the skin is firmly connected with the subjacent coarse fasciæ and muscles, and the scales adhere strongly. There are sixteen abdominal vertebræ, the six lower ones having their transverse processes connected by a bridge of bone, so as to enclose a small round opening; and about eighteen caudal vertebræ. The first of the latter has a descending process, with scoop- or spout-shaped arms enclosing a large oval opening, and much inclined backwards. The corresponding processes of the succeeding vertebræ are similar, but their openings are smaller and their limbs narrower, though their inferior spinous points are longer, up to the seventh or eighth, when they again decrease successively in length. The colour of the fish in spirits is dark brown marbled with grey spots, most conspicuous on the belly, where the ground-colour is much lighter.

Rays.—Br. 6 — 6; P. 9 and VI.; V. 1|5, the last deeply divided; D. 16| — 1|17; A. 3|8; C. $16\frac{5}{5}$[1].

DIMENSIONS.

	Inches.	Lines.
Length from intermaxillary symphysis to extremity of upper caudal lobe	24	0
Length from intermaxillary symphysis to base of caudal	20	8
Length from intermaxillary symphysis to end of dorsal	18	0
Length from intermaxillary symphysis to end of anal	16	9
Length from intermaxillary symphysis to anus	14	3
Length from intermaxillary symphysis to beginning of soft dorsal	13	0
Length from intermaxillary symphysis to ventrals	7	2
Length from intermaxillary symphysis to beginning of spinous dorsal	5	6
Length from intermaxillary symphysis to pectorals	4	4
Length from intermaxillary symphysis to tip of gill-flap	4	8
Length from intermaxillary symphysis to centre of eye	2	2
Diameter of orbit	0	8
Length of pectorals	3	8
Length of ventrals	2	3
Length of anal	2	0
Length of spinous dorsal	7	0
Length of soft ditto	5	6

[1] The following are the formulæ of the fin-rays in a specimen of *Aplodactylus punctatus* taken at Valparaiso, and of one in Mr. Darwin's collection, but the place of capture not noted:—

Br. 6 — 6; P. 11 and IV.; V. 1|5; D. 15|— 1|20; A. 3|7; C. 17.—*Hist. des Poissons.*

Br. 6 — 6; P. 9 and VI.; V. 1|5; D. 15|— 1|21; A. 3|8; C. 17.—*Jenyns and Darwin.*

	Inches.	Lines.
Length of caudal lobes	3	4
Length of central rays of caudal	2	7
Height of fifth and sixth dorsal spine	2	3
Height of third or fourth soft ray of dorsal	2	6
Height of soft anal	2	6
Length of space between dorsal and caudal	2	9
Length of space between anal and caudal	3	11
Height of body	5	9
Height of tail	2	6
Height of head at nape	3	9

The Chili *Apl. punctatus* described in the 'Histoire des Poissons' was a foot long, and the one brought home by Mr. Darwin measured eleven inches. (Zool. Beagle, Jenyns, p. 15.)

The first example of this genus was discovered by Solander on the coast of New Zealand, and named by him '*Sciæna mæandratus.*' The following extracts respecting it are from his 'Pisces Australiæ:'—"*Piscis sesquipedalis olivaceo-fuscus rivulis anastomosantibus, maculisque parvis, albidis, maculosus: subtùs dilutior et sub ipso abdomine albidus.*" "*Dentes numerosi, in utrâque maxillâ plurium ordinum lanceolati, compressi, obtusiusculi, flexiles: in palato pauci acerosi: in linguâ nulli.*" "*Pinnæ pectorales ovatæ, obtusæ, breves, dimidiam partem abdominis non attingentes, muticæ, basi extus rivulosæ, cinereæ, immaculatæ,* 14-*radiatæ: radiis inferioribus cute crassâ tectis.*" "*Pinna analis, latè rivulosa, acuta,* 7-*radiata, radio antico simplici, postico bipartito.*" "*Pinna caudalis olivaceo-nigricans, nebulis pallidioribus.*" "*Habitat propè* Cape Kidnappers."

Br. 6 — 6; D. 16|—18; P. 14; V. 1|5; A. 1|6; C. 17.

Parkinson's figure of this species (No. 65, Banks. Lib.) is not finished, but it shows distinctly the intricate patterns of the markings below the lateral line, which are very different from those of *punctatus* or *arctidens*. He has noted on the sketch, that "the whole back of this fish and the fins are green-gray, speckled with black, the ground-colour gradually becoming paler towards the belly." The head is scarcely gibbous over the orbit, the spinous dorsal is higher than the jointed one, and the caudal is truncated, with the corners rounded.

TRIGLA VANESSA, *Spiny-sided Gurnard.*—*Trigla vanessa*, Zoological Proceedings, June 25, 1839.

Tab. V. Fig. 1.

Trig. squamis asperis mediocribus; lineâ laterali aculeatâ; fossâ dorsali ad finem usque pinnæ posterioris armatâ; orbitâ oculi edentatâ; pinnâ pectorali amplâ labeculis aculeis binis ornatâ; maculâ nigrâ inter radium pinnæ dorsi anterioris quintum et octavum.—Radii. Br. 7 — 7; P. 11 — III.; V. 1|5; D. 8|—12; A. 12; C. $13\frac{8}{9}$.

There are two species of *Gurnard* in the collection very distinct from all that have been hitherto described, and, as far as we know, they are the first that have been brought from Tasmania, though one species (*Tr. kumu*) is known to inhabit the seas of New Zealand. They agree with that species, with several from India, and with the *T. pœciloptera* of the Mediterranean, in the pectorals being ornamented by large black eye-like marks, on which account we have named them, following the examples of Solander and Cuvier, after Lepidopterous groups, whose wings are somewhat similarly adorned. The stomach of *Trigla vanessa* contained exuviæ of *Malacostraca*.

Form having the general character of other Gurnards. The greatest thickness, both vertically and transversely, is under the middle of the first dorsal, from whence both dimensions gradually decrease to the tail. Behind the dorsal and anal the height is only one-fourth of what it is behind the pectorals. The greatest width of the shoulder is on a line with the humeral spine, or midway between the back and belly. The head is more compressed, and its length, measured to the tip of the gill-cover, is exactly one-third of the total length of the fish, excluding the caudal fin, its height at the nape being equal to one-fourth, or including the caudal, to one-fifth. The cranium is narrowed and deeply hollowed between the eyes, and the anterior quadrant of the orbit gives the form to a corresponding extent of the profile, from whence the line slopes down to the snout. The sides of the head are flat and nearly vertical, and the whole is encased in bones which are everywhere roughly studded with minute tubercles or blunt spines. These are generally more acute on the margins of the bones, where they form very fine serratures or denticulations, and are most perceptible on the edges of the infra-orbitars and anterior frontals, but may be discovered by the aid of a lens on all the bones. Most of the granulations, when minutely inspected, appear to be the raised orifices of pores, and on the infra-orbitars and some other bones there are in addition small irregular openings lined with membrane, and communicating with cavities beneath the granulated surface. On the orbitar margins of the anterior and posterior frontals, and on the upper surface of the snout, the granulations are disposed obscurely in radiating lines. Between the orbits the granulations are much less prominent and crowded than on the occiput or before the eyes, and there are no spinous teeth on the margin of the anterior frontal bounding the orbit. The orbit is round, and its inferior margin is pervaded by a soft furrow, which is prolonged to the snout along the upper edge of the preorbitar. The nostrils are situated in this furrow, nearer to the snout than to the eye. The anterior process of the preorbitar, which forms the side of the snout, is comparatively narrow, and is obliquely truncated, there being no sinus betwixt it and its fellow, except the usual horse-shoe-shaped space, which is filled with membrane. A strong conical acute spine occupies the greater part of the end of this process; there is a much smaller spine at its base exteriorly, and on the inferior edge of the preorbitar there are some rough granulations or serratures.

The preoperculum has a flat granulated surface, without ridges or perceptible radiation.

At its angle there are two spinous points, with a narrow rounded notch between them, and beneath them the interoperculum is firmly joined to the base of the preoperculum. The operculum is small and triangular, with a short flattish spine at its posterior corner, and its upper edge is divided from the hinder one by a projecting, angular, but not spinous point. A stiff membranous flap underlies the bony operculum, and its most posterior part is a rounded lobe, situated above and behind the upper angular point of the bone. The supra-scapular soldered to the occiput projects backwards to beyond the third dorsal spine, having acutely serrated edges and a sharp spinous point. The scapula has a nearly semicircular form, with a central ridge, which is prolonged into an acute spine of the same size with the preorbitar one.

The gape of the mouth extends backwards as far as the anterior nostrils. The thin lips, gill-membranes, and a considerable space round the pectoral and ventral fins, and forwards to the symphysis of the lower jaw, are clothed with smooth white skin. The limbs of the lower jaw are granulated, though not so coarsely as the rest of the head, and the granulations are more distinctly porous. The teeth on the intermaxillaries are short, close, and villiform. There is a small dental surface on the chevron of the vomer, not very perceptible to the eye, and also two pairs of patches of densely crowded villiform teeth on the upper pharyngeal bones, and one pair on the inferior bones. The rakers of the exterior row on the outer branchial arch are short, spatula-shaped, and studded on the tips with minute teeth. All the other rakers are still shorter. The tongue is smooth.

The body is covered with rather large scales, which are irregularly oval, and often oblique. The basal half of each scale is impressed by five or six undulations or furrows, producing corresponding crenatures on the margin, and the uncovered surface and margin are studded with minute spiny points. There are about twenty-one rows of scales in a vertical line on the fore part of the body; four above the lateral line, and sixteen below it. The lateral line runs near the back, and forms an acute and not much elevated spiny ridge, which forks when it meets the caudal fin, and is lost on its surface; it is composed of seventy-five scales up to its bifurcation. These scales do not exceed those of the body in size, but have a widely different form, being tubular, both longitudinally and transversely, and in fact bearing no very distant resemblance to the heads of some species of *Zygænæ*. The uncovered part of the scale is armed on the surface and margin with strong spines, which also appear to be hollow. The spines become fewer the nearer the scales are to the tail.

The dilated ends of the dorsal interspinous bones form twenty-seven plates, which bestride the back like so many saddles with the hollow side turned upwards, each flap or wing terminating in an acute triangular spine directed backwards, and forming, with its fellows, a serrated margin to the dorsal furrow on each side of both dorsal fins. These plates are successively narrower as they are more posterior, and two or three of the foremost ones have more than one spinous point.

The pectoral fin reaches backwards to about the eighth anal ray, and measures more than one-third of the whole length of the fin, caudal included. Of the eleven rays enclosed in the membrane, the first and last are simple, and the others are more or less forked: the fifth and sixth are the longest. The three free rays are connected by thick integument at the base only, and are about one-third shorter than the fin, the upper one being rather the stoutest and longest. The ventrals, situated beneath and immediately behind the free rays of the pectoral, exceed them a little in length, but do not reach beyond the first anal ray. The spine is one-third shorter than the longest branched ray. The first dorsal commences between the supra-scapulars, there being no interspinous plate before its first ray, but merely a square scaly space between it and the cranium. The spinous rays diminish gradually from the third to the eleventh and last, which is very short; the second, in the only specimen of the fish which we possess, is broken, but it was probably, when entire, the longest of all; the first, which is about one quarter shorter than the third, is serrated anteriorly by close incumbent spines, as is also the upper part of the stump of the second. The second dorsal, supported only by articulated rays, commences closely behind the membranous termination of the first one, and is not so high. Its rays are successively shorter from the third to the last, which is only half the length of the first articulated ray, and about equal in height to the eighth or ninth spinous one. The anal fin is equal in the length and number of its rays to the second dorsal, and carries its depth far back; most of its rays are simple and slender, but articulated: the caudal is moderately forked.

The colours of the specimen are not preserved, but there still remains a black patch on the edge of the first dorsal, between the fifth and eighth spines, and the posterior surface of the pectoral retains a dark purple hue with two contiguous black patches near the tips of the eighth and ninth rays, surrounded by a white border and studded with white spots.

DIMENSIONS.

	Inches.	Lines.
Length from end of snout to tip of caudal lobes	10	0
Length from end of snout to forking of lateral line on caudal .	8	3
Length from end of snout to anus	4	4
Length from end of snout to tip of scapular spine	3	0
Length from end of snout to tip of supra-scapular	2	11
Length from end of snout to tip of opercular spine	2	8
Length from end of snout to anterior edge of orbit	1	2
Length of pectorals	3	4
Length of ventrals	2	6
Length of attachment of first dorsal	1	10
Length of attachment of second dorsal and of anal	2	8
Height of third spinous ray of first dorsal	1	10

	Inches.	Lines.
Height of soft rays of second dorsal and anal	2	8
Length of descending branch of stomach from gullet	0	9
Transverse diameter of stomach	1	3
Length of gut from pylorus	7	3
Length of longest cæcum	2	1

The descending branch of the stomach is widely oval, and gives off the pyloric branch about one-third of the length from the gullet, leaving a 'cul de sac' beneath it of another third, while the junction of the two branches occupies the middle third. The pylorus is contracted to the diameter of the gut which proceeds from it; and just beneath it the intestine is surrounded by eight long cæca, the longest of which is twice the length of the shortest, but only one-fourth of the length of the whole intestine. The liver appears to be very small, but it may have been injured. The air-bladder is large, and consists of two globular sacs united to each other for half their length: its coats are thick and satiny.

TRIGLA POLYOMMATA, *Stiletto-beaked Gurnard.—Trigla polyommata,* Zool. Proc., June 25th, 1839.

Tab. V. Fig. 2.

Trig. squamis minutis lævibus; lineâ laterali inermi; fossâ dorsali ad finem usque pinnæ anterioris aculeatâ, posticè exossâ obsoletâque; orbitâ oculi lævi; aculeo ossis preorbitaris antrorsum exstanti, maximo.

Radii.—Br. 7 – 7; D. 8|–12; A. 12; V. 1|5; C. $13\frac{2}{9}$; P. 12 – III.

Form considerably compressed. The greatest depth of the body occurs at the beginning of the dorsal, and is equal to one-fourth of the total length, caudal included. The profile of the belly, from the under jaw backwards, is nearly straight; that of the back slightly curved, from the forehead. At the end of the dorsal and anal fins the body tapers suddenly into the short but slender tail, whose depth does not exceed one-fourth of that of the fore part of the body. The sides of the head are quite flat; the sides of the body are flattish, and the thickness diminishes gradually into the tail, which is almost round, the caudal fin being set on in such a manner that the short incumbent rays form a thin ridge or keel above and below.

The head, measured from the symphysis of the upper jaw to the nape, forms one-third of the total length, excluding the caudal; its flat sides are vertical, and its height at the nape exceeds its length. The profile descends more abruptly before the orbit than in *T. vanessa*; between the orbits the cranium is narrower and is smoothly excavated, and posteriorly it is flat and finely and equably granulated, without any appearance of radiation. The space included between the supra-scapulars is semicircular (not rectangular, as in *vanessa*). The whole side of the head is dotted with minute rounded pits, like the surface of a sewing thimble; these pits being finer and shallower on the cheek, and running into indistinct vertical furrows on the limb of the preoperculum: they do not show in the skeleton. The spines which arm the head are all stiletto-shaped, more or less triangular, and very acute. The preorbitar tapers anteriorly into a stout acute spine, which is marked by two ridges that diverge, and skirt the upper and lower margins of the bone. The triangular space included between these ridges has less lustre than the rest of the side of the head: on the margin of the preorbitar, beneath the hinder part of the inferior ridge, the little pits assume a radiated disposition. The base of the preorbitar spine and adjoining edge of the bone is roughened by minute granulations or serratures, distinctly visible only by the aid of a lens. There is a similar very minute serrature on the orbital margins of the anterior and posterior frontals; but there are no teeth whatever on the circumference of the orbit, which is rather larger than that of *vanessa*. In the skeleton the border of the anterior frontal is marked by rays or furrows inclining backwards. There is a membranous furrow within the under edge of the orbit, but it is not continued forwards to the nostrils so evidently as in *vanessa*, being interrupted by the upper ridge of the infra-orbitar. The preoperculum is an acute triangle, with a short base, to which the small interoperculum is firmly united; it has no horizontal limb, but a very acute spine (which is the smallest on the head) projects directly backwards from its base or angle. The surface of the interoperculum is rather coarsely pitted and somewhat radiated, and its posterior angle is acute, but not spinous. The bony operculum has the general form of that of the Gurnards, having a prolonged narrow point beneath, a smaller slender angular point above overlying the rounded lobe of the membranous flap, and in the middle posteriorly a spine which reaches backwards to the insertion of the pectorals. The supra-scapular spines, which are rather longer than the opercular ones, reach to the second dorsal ray, and the scapular ones, being the longest and most acutely triangular of the whole, reach to about the sixth dorsal spine.

Mouth.—The preorbitar spines form a notch at the end of the snout fully as deep as in the Malarmats, and the membranous space behind has the usual horse-shoe shape. The nostrils, as in other Gurnards, are close to it. The gape of the mouth is wider than in *vanessa*, extending beyond the posterior nostril. The jaws are armed with very minute villiform teeth, and there is a small transverse patch of still more minute ones on the chevron of the vomer. The palate is smooth. The pharyngeal teeth are similar to those of *vanessa*, but the outer row of rakers on the exterior branchial arch, instead of being rounded with knobbed summits, are compressed, awl-shaped, very acute, and fringed on the edge with hair-like teeth. On the other arches, and on the inner edge of the outer arch, the rakers are merely sessile, wart-like knobs with bristly teeth, as in *vanessa*.

The scales are very minute, and appear like little pits on the surface of the teguments, in which they are deeply imbedded. They can be seen distinctly only with the aid of a microscope, and when detached and so examined, most of them appear to be oblong, though some are circular, exhibiting concentric lines of structure, entirely destitute of any spinous roughness on the surface or margin: some have two or three furrows on the base, with corresponding crenatures on that edge, but very many are entirely devoid of such impressions. The scales, though more widely separated on the belly, are more visible there, owing to the milky appearance of the integuments. There is the same naked space on the thorax, and round the pectoral and ventral fins, as in the other species. The lateral line is formed of little tubular elevations of the integument, and runs nearly straight from beneath the supra-scapulars to the middle of the tail, forking as usual on the base of the caudal fin.

The second and third spinous rays of the first dorsal are the longest; the first and fourth are very little shorter; and the more posterior ones diminish in succession both in height and thickness, the last one being very fine and short. The anterior ones are stout, and the height of the longest is equal to two-thirds of the depth of the body. The lower halves of the first two are serrated anteriorly by the points of appressed spinules, which cannot be seen without the assistance of a lens; the rays, being near each other at the bases and diverging in a fan-like manner at the tips, resemble those of the Weavers (*Trachinus*). The dilated summits of the first ten interspinous bones form a shallow furrow for the reception of the spinous dorsal; the more anterior of these dilated ends or dorsal plates are widest, the others diminishing in succession to the last, which is a mere point. They are a little undulated on the edges, but neither crenated nor spinous in the smallest degree. The foremost one has a semicircular outline and forms a flat plate *before* the first spine, the fish differing in this respect from most other Gurnards. The second dorsal has none of these plates at its base, which is another peculiarity of the species; it has a slightly arched form, and is supported by twelve articulated rays, the first three of which are simple. The anal, commencing opposite to the second dorsal, extends rather further back and has somewhat longer rays. The pectoral fin is very large with a rounded circumference, and reaches half its own length beyond the anus. The three free rays are slender, all of them pass the anus, and the longest, when laid back, just reaches to the tip of the ventral.

The specimens, after maceration in spirits, show traces of a reddish or purplish tint on the back; the sides retain a silvery hue, and the belly is whitish. The pectoral fin appears to have been of a purplish colour on its posterior surface, with small spots of blue among the upper rays, and many yellowish dots below. There are also on that side of the fin two large, contiguous, black, eye-like marks with narrow white borders, one spot between the seventh and eighth rays, and the other between the eighth and ninth; these spots show imperfectly on the anterior surface when the fin is extended. There is a dark bar across the lower tip of the caudal.

Anatomical notices.—Descending branch of the stomach as in *T. vanessa*, but the pyloric branch is much smaller and more contracted at its origin, below which it dilates to a globular form and then contracts again to form the pylorus. The 'cul de sac' beneath the origin of the branch forms half the stomach. The gut is delicate, and decreases in diameter as it recedes from the pylorus; it contained marine insects. There are eight pyloric cæca, more slender and proportionably shorter than in *T. vanessa*.

DIMENSIONS.

	Inches.	Lines.
Length from tip of preorbitar spine to tip of caudal	5	4
Length from end of snout to base of caudal	4	0
Length from end of snout to anus	2	3
Length from end of snout to first dorsal spine	1	$7\frac{1}{2}$
Length from end of snout to occiput	1	$3\frac{1}{2}$
Length from end of snout to apex of gill-cover (upper angle)	1	5
Length from end of snout to anterior margin of orbit	0	7
Greatest depth of body	1	10
Length of pectorals	2	0
Length of ventrals	1	1
Length of attachment of second dorsal	0	11
Length of attachment of anal	1	2
Length of third spine of dorsal	0	9
Length of caudal	1	2
Length of descending branch of stomach from gullet	0	11
Length of gut from pylorus to anus	3	3
Width of occiput	0	$7\frac{1}{3}$

SCORPÆNA MILITARIS (Nob.), *Soldier-fish.*

Scorp. capite breviusculo, cirrhis nullis?, spinis capitis ferè Scorp. porci vel bufonis, operculo summo genisque squamosis; squamis corporis ciliatis; colore carmesino.

Radii.—Br. 7—7; P. 16; D. 12|10; A. 3|5; V. 1|5; C. $12\frac{3}{3}$.

In the 'Histoire des Poissons' we find the following remark:—"The *Scorpænæ*, properly so called, have the head bristled with crests and spines, and enveloped in a spongy skin: it is with difficulty that one can discover in dried specimens some small scales on the hinder part of the head and upper margin of the operculum." In specimens, however, of what I have considered to be the *Scorpæna bufo*[1] (Cuv.) (because they have the milk-white spots in the axillæ, and agree otherwise in the most minute particulars with the description of the species contained in the work just quoted), the whole

[1] Vide Fauna Bor. Amer. Fishes, p. 300, for detailed descriptions of Newfoundland specimens. I have a specimen of the same fish from Jamaica with the denticulated nasal spines, which are characteristic of *bufo*.

cheek is protected by scales, as well as the greater part of the operculum; its posterior border, and the membrane between the ridges, alone being naked. The scales even spread over the union of the operculum and suboperculum, though in a scattered manner; the interoperculum is naked. These scales are not visible until the thick epidermis is dried and rendered transparent by varnish[1]. A small *Scorpæna* from Port Arthur nearly resembles *bufo* in this respect, the scales however not covering quite so much of the operculum. It is known, locally, by the name of "Soldier-fish," and is esteemed for the table. Mr. Lempriere notes the specimen as having been of a "lively flesh-colour" when recent, and as being considerably below the usual size of the species. The colours have been destroyed by maceration in spirits, and the same cause has rendered the existence of membranous processes on the head problematical. A second specimen, rather larger, has more recently been received from the same quarter preserved in brine.

Form in general that of *Scorpæna bufo*; the body is less high and more compressed than that of *porcus*, and the head is shorter, being less than one-third of the total length, caudal included. The spines of the head are the same in number and similarly situated with those of *bufo*, but are all more prominent and acute, particularly three which occupy the upper margin of the orbit, and are large, hooked backwards, and trenchant. These spines are more distinctly separated from each other by notches than those of *porcus*. The under preorbitar spine is more slender and acute than in either of these species, and the spiny ridge running backwards from it beneath the eye is more sharply elevated. The interorbitar ridges are much more clearly marked than those of *bufo*, being exactly similar to those of *porcus*, except that each terminates in an acute though minute spine. The spines on the hinder part of the head, as well as those on the preoperculum and operculum, are more slender and acute than in *porcus*. The scapular bone is armed as in *bufo* with two small spines, one over the other, and the clavicular spine is the same as in *porcus*. The nasal spines are not dentated, and the opercular ridges are perfectly simple, not fasciculated as *nesogallica*.

Scales disposed on the body so as to present oblique rhombs, in a very regular quincuncial order. They are larger than those of *porcus*, are marked on the base with from eight to twelve furrows with corresponding marginal crenatures, and their free edges are finely ciliated with slender, minute and fragile teeth, but they do not show the strong radiating striæ which characterise the scales of *porcus*. There are about forty scales on the lateral line, nearly every alternate one having a tubular ridge, which is free at the tip. No other cirrhi or skinny filaments are visible on the two specimens. The cheeks are covered by very thin, flexible, circular, oval, and in some places irregular scales; and the operculum is protected as low as the upper ridge by similar scales, which form a patch running forwards to the orbit, and bounded above by the supra-

[1] I could detect no scales on the cheeks or opercula of two specimens of *Scorpæna porcus*, nor on one of *Sc. scrofa*, which I received from the Mediterranean.

scapular ridge, and below by the upper opercular one. These scales are not visible until the smooth skin is scraped, and they are not tiled as on the body, but the central ones overlie the surrounding ones on all sides. There are no scales between or below the ridges of the operculum, on the suboperculum or interoperculum. The muzzle and jaws are also scaleless, in which respect this *Scorpæna* differs from the *Sebastes minutus* of the 'Histoire des Poissons.' The top of the head is covered by soft skin which is sparingly granulated.

The spinous part of the dorsal is more boldly arched than in *porcus*, and is equal in height to the soft rays of that fin or of the anal. The spines are more strongly grooved towards their tips than in *bufo* or *porcus*. The second anal spine, as strong as that of *porcus*, is more slender than in *bufo*, and is longer than the third one. The uppermost pectoral ray is simple, as are also nine lower ones on one side and ten on the other. The table of dimensions furnishes the means of ascertaining the proportions of the various parts of the fish to each other.

These particulars are mostly ascertained from the examination of the smaller specimen, which was preserved in spirits. The larger one, which was put up in strong brine, was perfectly sound, but long friction against many large grains of undissolved salt had injured its spines. There are the remains of two or three large dark patches on the side and along the dorsal in this specimen, and the top of the head is dark.

Dimensions.

	1st Specimen. Inches.	Lines.	2nd Specimen. Inches.	Lines.
Length from intermax. symph. to end of caudal fin	4	3	6	0
Length from intermax. symph. to beginning of caudal fin	3	3½	4	10
Length from intermax. symph. to end of dorsal	2	11	4	3
Length from intermax. symph. to end of anal	2	8	4	0½
Length from intermax. symph. to beginning of anal	2	3	3	4
Length from intermax. symph. to anus	2	0	3	0
Length from intermax. symph. to point of gill-flap	1	3	1	9
Length from intermax. symph. to beginning of dorsal	1	2	1	5
Diameter of circular orbit	0	4	0	5
Breadth of space between the orbits	0	2½	0	3½
Length of pectorals	1	1	1	2½
Length of ventrals	0	10	1	2
Length of dorsal	2	0	2	11
Length of anal	0	6	0	10
Length of caudal	1	0	1	3
Height of third dorsal spine	0	8	1	0
Height of soft rays of dorsal	0	7½	0	9½

	1st Specimen. Inches.	Lines.	2nd Specimen. Inches.	Lines.
Height of soft rays of anal	0	8	1	0
Height of body	1	0	1	$7\frac{1}{2}$
Thickness of body	0	6	0	8
Thickness of head	0	9	1	1

SEBASTES MACULATUS (Cuvier ?), *Southern Sebastes.*

The collection contains specimens of a fish which is noted in Mr. Lempriere's list as having when recent " a bright red colour with brown spots," and as being " very good for the table," where it is served under the local name of ' gurnett.' On examining the specimens carefully with reference to the brief account given of the *Sebastes maculatus* in the ' Histoire des Poissons,' no discrepancy was detected, except that the post-orbitar spines do not altogether correspond with the description of those of *imperialis*, which *maculatus* is said nearly to resemble. This difference, though sufficient to excite some doubts of the identity of the Van Diemen's Land fish with the Cape of Good Hope *maculatus*, is not so important as to authorise the application of a new specific name to the former until the matter shall be decided by an actual comparison of specimens.

Description.—Form in general that of *S. imperialis*, the profile descending in a slightly convex line, somewhat flattened on the cranium, from the dorsal fin to the end of the snout, which touches the longitudinal axis of the fish. The lower jaw ascends when the mouth is shut, and a conspicuous knob under its symphysis then forms the anterior apex of the head. The height of the body abreast of the pectorals is rather greater than in *Norvegicus*, being equal to one-third of the length from the snout to the middle of the caudal, or to the distance between the end of the snout and the tip of the lower opercular spine. The thickness of the body is equal to about one-half of its height. The orbit is round, and its diameter equals the space between it and the supra-scapular spines in one direction, or the intermaxillary symphysis in the other. The flap of the operculum goes about two-thirds of a diameter of the orbit beyond the supra-scapular spines. The interval between the orbits equals half a diameter, as in *imperialis*. The proportions of other parts may be readily obtained from the table of dimensions. Both nostrils have elevated margins, especially the anterior one, whose inner edge rises into a small ear-like flap.

The spines generally are short, stout and acute, with wide, ridged bases, but their points merely are seen in the recent fish. The two nasal spines are short but quite visible. The triangular and strongly keeled anterior frontal forms the largest spine on the margin of the orbit ; there are two other spines at the posterior upper angle much less conspicuous, and in some specimens almost obsolete. Immediately behind them there is a fourth spine, which terminates a thin ridge that commences at the nasal bones, and curves over the eye close to the edge of the orbit. This ridge is described as existing in *imperialis* and some other species, but not in *Norvegicus*. Closely following the fourth spine there are two and sometimes three other incumbent ones, forming as it were a continuation of the same ridge, bounding the occiput on each side, and terminating over the attachment of the upper limb of the supra-scapular bone. The supra-scapular is armed with two short spines, one over the other, as in some *Scorpænæ*, but there is no ridge extending from them to the orbit as in these. None of the *Sebastes* described in the 'Histoire des Poissons' are stated to possess more than one supra-scapular spine. The scapular bone has a thin acute angle not spinous, which readily makes its way through its thin covering of skin. The anterior infra-orbitar terminates above in a spinous point, which reclines flat on the surface of the succeeding bone, and on the inferior margin of the bone there are two projecting corners. The second infra-orbitar is prolonged backwards to touch the preoperculum, and to be connected with it by ligament; its ridge is perceptible on the cheek, and in one of the specimens there is a small spinous point near its middle. The preoperculum is armed with five stout spines, the second of which is the largest, and the fifth is close to the articulation of the lower jaw. Behind each there is a deep pit on the edge of the bone; and there is also a deep furrow on the upper third of the bone, where there are no spines. The bony operculum terminates in two small spinous points, separated by a wide sinus, and resting on a cartilaginous flap, which is prolonged considerably beyond them. This flap belongs, as usual, more properly to the suboperculum. There are no spinous points on the suboperculum or interoperculum.

Rays.—Br. 7 — 7; D. 12| — 12 or 13; A. 3|5, the last divided to the base.
P. 10. viii.; V. 1|5; C. 16.

The third dorsal spine is the highest, and is equal to half the height of the fish, as in *imperialis*. The others diminish in succession to the eleventh, which is rather shorter than half the height of the third. The twelfth equals the ninth. Almost all of them have a groove towards the tip. The soft dorsal is rather higher than the tallest spine. The first anal spine is short, the second is stouter, and as long, or even rather longer than the third: the soft rays are twice the length of these spines. The naked space between the anal and caudal is one-sixth of the total length of the fish, and its height is equal to the diameter of the orbit, or to somewhat less than a tenth of the total length. The pectoral is equal in length to one-fifth of the fish, and its axilla is scaleless with a bony plate; it contains eight simple rays.

The scales on the lateral line are oblique, sixty-five in number, and densely tiled. Behind the pectoral fins there are seven scales above and twenty below the lateral line on each side. The scales of the forehead terminate on a line with the posterior third of the orbit, the snout and space between the eyes being naked. There are small scales on the anterior orbitar and maxillary bones, as well as on the membranes of the fins. Three pores exist on each limb of the lower jaw, and some are visible on the infra-orbitar bones also.

The specimens have doubtless lost much of their original colour by maceration in spirits, but they still retain a general pinkish or boiled-lobster red colour, most lively on the fins, with dark brownish blotches on the jaws, top of the head, and dorsal fin. One broad dark band descends from the spinous dorsal down the sides beneath the pectoral; another, which is narrower and more patchy, takes in the base of the soft dorsal and dips down to the anal; and a still narrower one crosses the base of the caudal. There are also many small round dots on the spinous dorsal, and some on the bases of the soft dorsal and pectoral. The cornea is surrounded by a broad red ring.

Intestines.—The descending part of the stomach is wide, with thick coats plaited internally in eight prominent folds with smaller ones in the intervals. The œsophagus is short and wide, contracting slightly to form the commencement of the stomach. The pyloric branch of the latter is comparatively small, and has an upward direction, leaving one-third of the viscus as a 'cul de sac' beneath it. There are nine pyloric cæca. The peritoneal lining of the abdomen is black and the inside of the mouth brownish. There is no air-bladder. The vertebræ are twenty-five in number, eleven of them being abdominal.

Scorpæna cottoides (Forst. New Zeal. No. 190.), in the Banksian Library, has a general resemblance to this *Sebastes*: it is coarsely drawn in colours which have faded. The figure bears the date of 1st April 1773, Dusky Bay.

DIMENSIONS.

	1st Spec.		2nd Spec.		3rd Spec.	
	In.	Lin.	In.	Lin.	In.	Lin.
Length from interm. symphysis to end of caudal . . .	13	6	13	9	16	6
Length from interm. symphysis to base of caudal . .	11	7	11	10	14	6
Length from interm. symphysis to end of soft dorsal .	10	0	0	0	12	0
Length from interm. symphysis to end of anal . . .	9	7	0	0	11	9
Length from interm. symphysis to beginning of anal .	8	3	0	0	10	4
Length from interm. symphysis to beginning of soft dorsal	0	0	7	10	9	6
Length from interm. symphysis to anus	7	5	0	0	9	7
Length from interm. symphysis to spinous dorsal . .	3	8½	3	10	4	6
Length from interm. symphysis to last spine of superciliary ridge	0	0	3	4	3	9½
Length from interm. symphysis to tip of gill-flap . .	4	6	4	7	5	5
Length from interm. symphysis to posterior edge of orbit	2	4	2	6	2	8½
Length from interm. symphysis to anterior edge of orbit	1	2	1	3	1	5
Length of diameter of orbit	1	2	1	3	1	4
Length of distance between orbits	0	7	0	7	0	9¾
Length of spinous part of dorsal	4	4	0	0	5	3
Length of soft part of dorsal	2	2	2	2	2	4

	1st Spec. In.	Lin.	2nd Spec. In.	Lin.	3rd Spec. In.	Lin.
Height of third dorsal spine	1	10	1	11	2	0
Height of soft dorsal	1	10	1	11	2	0
Length of pectorals	2	10	2	8	3	$3\frac{1}{2}$
Length of ventrals	2	7	0	0	3	0
Length of anal	1	6	0	0	1	9
Length of caudal	1	11	1	11	2	2
Height of anal	1	11	0	0	2	1
Length from anal to extremity of caudal	0	0	4	$9\frac{1}{2}$	5	6
Length from dorsal to extremity of caudal	0	0	3	8	4	8
Height of body at pectorals	4	0	0	0	4	7
Thickness of body at pectorals	2	0	0	0	2	8
Diameter of the orifice of the mouth	2	4	2	4	2	4

Note.—The Cape specimens described by Cuvier were only seven inches long.

PLATYCEPHALUS TASMANIUS, *Tasmanian Platycephalus.*

Pl. tasmanius, osse preorbitari unidentato : orbitis inarmatis ; fastigiis cranii vix conspicuis ; preoperculo bispinoso, spinâ inferiori, longiori ; radiis pinnæ dorsi primæ septem vel octo spinosis ; secundæ quatuordecem articulatis.

The *Platycephali* abound in the Australian seas, and as the species resemble each other closely, not only in general form, but also in their brown colours and the distribution of the darker spots, it is difficult to find characters by which they may be readily known. Four New Holland ones are distinguished in the 'Histoire des Poissons,' from each other and from their congeners, by the number and strength of the spinous teeth on the infra-orbitar, the prominence of the cranial ridges, the size of the preopercular spines, and other minute particulars. Our specimens agree nearly with the description of *P. bassensis*, which was taken by Messrs. Quoy and Gaimard in Port Western, on the opposite side of Bass's Straits to Tasman's Peninsula. That species, however, has two blunt teeth on the edge of the preorbitar, while the four examples which we possess of *tasmanius* have but one projecting spinous tooth. Ours differ also in being destitute of a tooth on the edge of the orbit. *P. lævigatus* also, from Port Western, differs more in having no tooth at all in the preorbitar, and in the inferior preopercular spine being smaller than the upper one. In *P. fuscus*, from Port Jackson, the preopercular spines are both of the same size, and the preorbitar has two rounded teeth ; and in *P. grandispinis* there are not only three preorbitar spines, but the inferior preopercular one is four times the length of the upper one, and reaches to the edge of the operculum. It is possible that the size of the spines may vary with the sex or age of the fish, but as they have been used for characterizing the species in the 'Histoire des Poissons,' and we have no opportunity of comparing the actual specimens, no alternative remains but to describe the Port Arthur fish as distinct, though the differences they present are certainly very slight.

Colour.—The snout, sides of the head, gill-covers and body are marked at pretty regular distances by roundish and crescentic dark umber-brown spots, which are smallest and most crowded on the head, and larger on the sides, where the upper brown tints meet with the pale colour of the under surface; these large spots are continued from behind the pectorals in a regular series to the caudal fin. There is a broad subterminal band of the same colour on this fin, but it is continuous only on the lower half, being indicated above by several rows of roundish, irregular, and paler spots. There are many small spots on the pectorals, most distinct towards the bases of the upper rays, and also a few pale spots on the rays of the dorsals.

Form.—The lateral line is marked by a series of tubes, which turn downwards and are narrower at the tips; it runs straight from the supra-scapular to the extremity of the caudal, passing between the eighth and ninth rays. The scales are strongly ciliated.

Rays.—B. 7 – 7; D. 1|– 6|– 14, or 1|– 7|– 14; A. 14; V. 1|5; C. $12\frac{6}{6}$; P. 11 and VI.

The fin-membranes, especially of the dorsal and pectoral, are delicate. The first dorsal spine is short, and forms with its membrane a separate fin. The first ray of the posterior dorsal is simple but articulated at the tip; and it is longer than the succeeding ones, which are branched and diminish successively in height. The distance between the eyes does not much exceed half the diameter of the orbit, being less than in *fuscus* or *grandispinis.* A single short, subulate tooth projects over the limb of the maxillary bone, from below the notch of the anterior suborbitar, and there is an even ridge continued backwards from it to the angle of the preoperculum. This ridge, though conspicuous enough in the skeleton, barely shows in the recent fish, and has no spinous points. The under edge of the preorbitar is slightly undulated near the spine, but emits no second tooth. The mesial ridge of the snout is not continued to the interorbitar space, though in the skeleton a slight elevation is perceptible as far as the anterior third of the orbits. There are no teeth on the circumference of the orbit, but its upper edge is raised and acute. The temporal ridge is short and inconspicuous; a minute spine can be detected on it in the skeleton.

In the general smoothness of the head, and the existence of mere indications of cranial crests rather than their actual prominence in the recent fish, the species approaches near to the *lævigatus* of Port Western, but there are differences in the number of rays in the first dorsal, and in the suborbitar and preopercular spines as mentioned above. The operculum of *tasmanius* ends in a triangular, acute but not spinous point; and beneath, and projecting considerably beyond it, is the rounded, thin, cartilaginous, scaly flap of the suboperculum. The lower preopercular spine measures one-sixth of the length of the head, and is longer than the upper one, but not in an equal degree in all the specimens, nor on both sides of the head. It is longest in all of them on the right side, and in one example reaches nearly to the edge of the operculum, being in that case twice the length of the upper one. The jaws are more nearly of a length than in some other species. The teeth differ somewhat from those of *P. insidiator*, as described in the 'Histoire des Poissons,' particularly on the palate bones, where, instead of a single row, there is a villiform stripe, broadest in the middle, and nearly as wide as the band on the limb of the intermaxillary. There is a narrower stripe on the fore part of the vomer. Of the twenty-seven vertebræ eleven carry ribs.

Dimensions.

	Inches.	Lines.
Length from tip of lower jaw (mouth shut) to end of caudal fin	13	6
Length from tip of lower jaw to base of caudal	12	0
Length from tip of lower jaw to end of soft dorsal	10	8
Length from tip of lower jaw to end of anal	11	2
Length from tip of lower jaw to beginning of anal	7	0
Length from tip of lower jaw to anus	6	6
Length from tip of lower jaw to beginning of second dorsal	7	0
Length from tip of lower jaw to end of first dorsal	6	5
Length from tip of lower jaw to beginning of first dorsal	4	4
Length from tip of lower jaw to ventrals	4	8
Length from tip of lower jaw to tip of gill-flap	4	2
Length from tip of lower jaw to beginning of pectorals (upper ridge)	3	9
Length from tip of lower jaw to point of inferior preopercular spine	3	$4\frac{3}{4}$
Length from tip of lower jaw to anterior margin of orbit	1	4
Projection of lower jaw beyond the upper one	0	2
Long diameter of the orbit	0	8
Vertical diameter of the orbit	0	6
Space between the orbits	0	5
Breadth of the head at the angles of the mouth	1	6
Breadth of the head behind angle of preoperculum	2	9
Height of fish at the hind head	0	11
Height of fish between the dorsals	1	0
Height of second spine of dorsal	2	0
Height of second dorsal fin (soft)	1	5
Height of anal	1	1
Length of space between the dorsals	0	5
Length of first dorsal	2	2
Length of second dorsal	3	$9\frac{1}{2}$
Length of caudal	1	6
Length of pectorals	1	$8\frac{1}{2}$
Length of ventrals	2	2
Length of anal	4	4

APISTES MARMORATUS, Cuv. et Val. iv. p. 416.

Our specimens correspond exactly with the description of the species in the work referred to, except that the first suborbitar has only one tooth anteriorly, which is well-marked and acute. This bone is short, thin and triangular, giving out backwards the characteristic tapering spine, which in one specimen nearly reaches the preoperculum, but in another is one-third shorter, being only just the length of the preopercular spine, while in a third it is of intermediate length.

Mr. Lempriere informs me that this fish haunts shallow waters near sandy beaches, and is very poisonous, several persons having suffered from eating it. The natives dread it. Its Port Arthur appellation is 'Toad-fish.'

The skin is very smooth to the touch, and is loosely connected through the medium of tough fibres to the shining nacry fascia which invests the muscles. The stomach was filled with tender crustacea; its fundus is a very blunt 'cul de sac,' and the pylorus opens at two-thirds of the whole length of the viscus from the gullet. Nine cæca of unequal sizes surround the gut a short way beneath the pylorus: only six cæca are mentioned in the 'Histoire des Poissons.' The skeleton is exactly as described in that work, the number of the vertebræ being twenty-eight, of which eleven are abdominal. The teeth are also as therein mentioned, those on the pharyngeal bones and branchial knobs being like those of the palatine bones, vomer and jaws, very short and densely villiform.

CHEILODACTYLUS CARPONEMUS, Cuv. et Val. v. p. 362.

Radii.—B. 6; D. 17|31; A. 3|19; P. 9 *et* VI., V. 1|5.

Our example of this fish is a foot long, but it is said by Mr. Lempriere to reach the length of eighteen inches when full-grown, to be known locally by the name of the 'Perch,' and to have a bright silvery hue with dark spots. The specimen retains a dark tint on the top of the head, on the snout, and in the inside of the mouth; and there are vestiges of spots on the sides and fins, particularly the caudal one. A drawing of Dr. Lhotsky's, made at Port Arthur, represents the fish as silvery, with a brownish or purplish red hue on the back, but without spots, except a dark blotch on the tip of the gill-flap, another at the beginning of the lateral line, and a deep blue mark on the membranes of the jaws. In the 'Histoire des Poissons' the species is said to be sometimes spotted with brown on the back, and to have the fins yellowish. In some particulars our specimen differs from the figure (Plate CXXVIII.) in that work, such as the spinous portion of the dorsal being more arched, and the spines much thicker. The second spine is only half the length of the sixth, and the seventeenth is still lower, but the figure represents them as only one-sixth shorter than the longest spine. The soft rays are shorter, and decrease in height gradually towards the end of the fin. The whole fin falls back into a groove which is formed at the base of the soft portion by a distinct fillet on each side, clothed with three rows of small scales, not indicated in the figure[1]. The anal spines are also strong, and the second one is longer than the third one, which is the tallest in the figure. There are no scales on the anterior sub-orbitar of our fish. The tip of the operculum is flat, thin, and rounded; the flexible cartilaginous extremity of the suboperculum projects beyond it, and both are edged with soft membrane forming a rounded lobe, which is the tip of the gill-flap, and reaches to the base of the pectoral rays. The posterior edge of the preoperculum is free, so that it can be raised from a small furrow which is lined by scaleless integument. The edges of the smooth, oval, scapular bone, and of the bones in the axilla of the pectoral, can also be slightly elevated. All the bones of the axilla are covered with small scales, and their forms, as shown in our specimen, do not exactly agree with those represented by the figure. There are sixty-two scales on the lateral line, of which fifty are situated before the termination of the dorsal fin; a vertical row in the fore part of the fish contains twenty-one scales, four of them being above the lateral line. The stomach gives off a short pyloric branch high up; there are two very short cæca, and the rectum is much dilated, as described in the 'Histoire des Poissons.'

Dimensions.

	Inches.	Lines.
Length from intermaxillary symphysis to tip of tail (jaws closed)	12	3
Length from intermaxillary symphysis to tip of central caudal rays	10	10
Length from intermaxillary symphysis to base of caudal	10	5
Length from intermaxillary symphysis to end of dorsal	9	2
Length from intermaxillary symphysis to end of anal	8	2
Length from intermaxillary symphysis to beginning of anal	6	7
Length from intermaxillary symphysis to anus	6	2
Length from intermaxillary symphysis to ventrals	4	3
Length from intermaxillary symphysis to beginning of dorsal	3	2½
Length from intermaxillary symphysis to tip of gill-cover	2	10½
Diameter of orbit	0	9½
Diameter of mouth (vertical)	0	8½
Length of long pectoral ray	4	0
Length of ventrals	2	0
Length of caudal lobes	2	8
Length of caudal fork	1	4
Height of body (under sixth dorsal spine)	3	8
Height of tail (between dorsal and caudal)	0	9
Thickness of head at opercular point	1	3
Height of sixth dorsal spine (longest spine)	1	6

[1] The two upper pectoral rays are simple, and there are only six simple rays in the lower part of the fin, the uppermost of these six being the thick elongated one. In the 'Histoire des Poissons' there are seven inferior simple rays mentioned, the second being the long one.

	Inches.	Lines.
Height of seventeenth dorsal spine (the first is shorter, the second longer)	0	7½
Height of soft rays of dorsal	0	11
Height of second anal spine (the longest)	0	10
Height of soft anal rays	1	0
Length of anal	1	10

The Banksian library contains a drawing made by G. Forster on Cook's second voyage (vol. i. t. 207), marked *Sparus carponemus*, of a fish taken in Queen Charlotte's Sound, New Zealand, which is a pretty good representation of the form of ours; and there is another made at Matarruhow by Parkinson (tab. 52.), most probably from an individual of the same species. In both the dorsal spines agree better with those of our specimen than with the plate in the 'Histoire des Poissons.' Figure No. 206, made by G. Forster at Dusky Bay, and marked *Sciæna macroptera*, is also quoted by Cuvier as a representation of *Cheilodactylus carponemus*, but I think that it ought rather to be considered as belonging to a distinct species. It is a more slender fish than *carponemus*, with a more acute head, and is further characterized by a dark blotch behind the head. Its native name at Dusky Bay is 'Taraghee.' Figure No. 40. by Parkinson, of a fish taken in Queen Charlotte's Sound, is very probably another representation of this second species. It has a lower soft dorsal, with a more even spinous portion than *carponemus*, and the dark mark on the shoulder is still more clearly defined than in Forster's figure. A short description is given in Solander's MSS. *Pisces Australiæ* of a specimen taken off Cape Kidnappers, under the head of '*Sciænoides abdominalis*,' with a reference to Parkinson's figure, of which the following is an extract: "*Piscis compressus, totus suprà e plumbeo argenteus, subtùs argenteus. Os atrum. Pone caput per humeros, fascia lata nigra, ad basin pinnarum pectoralium non penitus descendens. Pinna dorsalis colore dorsi. P. pectorales supernè cinerascentes, infernè albidæ. P. ventrales et anales albidæ. P. caudalis e livido cinerascens. Radius decimus pinnæ pectoralis elongatus, incrassatus.*" A more extended description occurs in the same manuscript, drawn up from a specimen taken off Motuaro Bay, Queen Charlotte's Sound. Extract:—"*Caput parvum supernè ferè ad rostrum squamosum, ante oculos nudum obtusum. Faux nigra. Branchiarum opercula integra squamosa. Membrana branchiostega 6-radiata, tecta. Dorsum acutum in medio rectum, ibique fossulâ exaratum pro parte spinosâ pinnæ dorsalis recipiendâ, posticè descendens margine elevato basin pinnæ dorsalis amplectens. Pectus carinatum. Pinna dorsalis 43-radiata, radiis 17 anterioribus spinosis, crassis, altioribus; reliquis muticis*[1]. *Pinnæ pectorales muticæ, 15-radiatæ: radio decimo longissimo, ponè initium pinnæ analis elongato: reliqui duplò breviores. Pinna ani, uti pars postica pinnæ dorsalis, basi amplexa marginibus elevatis, intra quos recondenda, 17-radiata: radiis tribus anterioribus spinosis: secundo valido.*"

[1] Forster's figure No. 206. exhibits only fourteen spinous rays. It is stated to have been drawn from the living fish, while 207 is said to be from a dead subject.

CHEILODACTYLUS GIBBOSUS, *Parkinson's Cheilodactylus.—Chætodon gibbosus*, Banks. Icon. ined. t. 23. Parkinson. *Cheilodactylus gibbosus*, Rich., Zool. Proc.

Ch. formâ Cheilodactyli zonati, (h. e. capite brevi, ore parvulo, dentibus setaceis; dorso gibbo; spinâ dorsali quartâ longissimâ:) radiis pinnæ dorsalis articulatis radios spinosos numero plus duplo excedentibus.

Radii.—P. 8 *et* VI.; D. 17|36; V. 1|5; A. 3|8; C. $14\frac{4}{4}$.

In the atlas of Krusenstern's Voyage round the World (pl. 63. f. 1.), there is a figure of a fish which was captured in the Japanese seas. This species is described in the 'Histoire des Poissons' under the name of *Ch. zonatus*, but differs considerably from the other *Cheilodactyli* in the form of the body, which is highest in the pectoral region, and tapers in a lengthened manner into the slender tail; the mouth is placed on a low level, and the arc of the nape is sudden and bold. The three first dorsal spines are short, the fourth is very tall, and the succeeding ones decrease so as to impart a steeply arched form to the anterior part of the fin. There is also a blunt, horn-like protuberance on the anterior margin of each orbit, and the heads of the maxillary or labial bones project strongly on the snout. The mouth is small, and the teeth are slender, like those of the Chætodons, though shorter [1]. These characters, which are sufficiently prominent to mark a minor or subgeneric group, are all reproduced in a West Australian fish, of which two specimens were brought home by Mr. Gould. This southern species differs from its northern analogue in the disposition of its bands of colour, and in the number of articulated dorsal rays, but agrees closely in general form and aspect. There are also evident crenatures on the lower limb of the preoperculum, while the edge of that bone is described as being entire in *zonatus*. One of Mr. Gould's specimens is deposited in the Museum of Haslar Hospital, and the other in the British Museum; and I am indebted to J. E. Gray, Esq. for kindly examining the Banksian collection of drawings, and ascertaining that Parkinson's figure (vol. ii. t. 23.) of a fish taken in Endeavour River, on the east coast of New Holland, is a correct representation of this species, though the projections on the orbits are not depicted. By comparing Mr. Gould's two specimens, this character is found to vary, being perhaps a sexual peculiarity, and there is therefore no reason on that account to doubt that the same species inhabits both coasts of New Holland. The name attached to the drawing is *Chætodon gibbosus*, and I have preserved the specific appellation.

Form.—Much compressed; the profile highest beneath the fourth and longest dorsal spine, that is, a little before the tip of the gill-flap and base of the pectorals; from thence it tapers gradually to the slender tail, but so that the belly ascends little in comparison with the descent of the back; and a straight line drawn through the mouth and pectorals to the centre of the caudal fin, leaves about three-quarters of the entire height of the body above it. The profile from the fourth dorsal spine to the orbits is

[1] There is an example of *Cheilodactylus zonatus* from the China seas, in the British Museum.

a quadrantal arc, and from thence to the heads of the maxillary bones it descends in a straight line. The caudal fin is deeply forked, and springs from the slender tail in a somewhat similar manner to that of the common *Mackerel*. The head is compressed; the snout narrow. On the anterior angle of each orbit, immediately over the nostrils, there is a blunt projection which varies in size in the two specimens, forming in the one belonging to the British Museum a conspicuous horn, but being in the other scarcely more distinct than the end of the maxillary bone, which forms a knob on the side of the snout in the dried fish. The intermaxillaries have a slight protractility, their pedicles gliding between and beneath the maxillary knobs. The gape is small, the angle of the mouth not extending more than half way to the orbit. Narrow belts of short villiform teeth arm the intermaxillaries and lower jaw, lying considerably within the tumid lips. The maxillary bone lies well behind the orifice of the mouth, its tip alone touching the angle of the gape. The nostrils pierce the posterior half of a triangular membrane, the hinder orifice being close to the orbit, and rather above its centre. The suborbitar bone is more restricted than that of *Ch. carponemus*, and is covered by smooth skin which is perforated by many mucous pores. The moderately large eye is situated near the profile of the forehead, and fully its own diameter above the lower limb of the preoperculum, which is on a line with the pectoral fin and corner of the mouth. The inferior edge of the preoperculum is distinctly crenated, though it is probable that the crenatures are not visible in the recent fish; the rounded angle and the vertical upper limb have smooth edges. The bony operculum ends in a thin, flat, acute point, above which there is a wide rounded notch, occupied by scaly membrane, and terminated by a shorter point. The flexible and scaly tip of the suboperculum projects beyond the operculum. The whole gill-flap is edged with smooth membrane, and has an obtuse triangular form, its apex passing a little beyond the base of the upper pectoral ray. I was able to count five gill-rays in the Haslar specimen, and there may be a sixth.

The eight upper rays of the pectoral have branching tips, the six lower ones are simple; of these the second projects backwards to the anus, and is one-third longer than the adjoining rays above and below; the rest diminish in succession, both towards the first and last ray, but the inferior ones more rapidly, so that the lowest has only one-fourth of the length of the longest. The ventrals are attached beneath the posterior third of the branching pectoral rays, and are pointed; the spine has a flexible tip, and is one-third shorter than the soft rays which immediately follow it. The dorsal commences over the vertical limb of the preoperculum; its fourth spine is by much the tallest, and its height rather exceeds the length of the space between its base and the pectoral fin; the three spines anterior to it, though strong, are very short; the fifth is one-sixth shorter than the fourth, after which the rest decrease very slowly, so that the seventeenth is about half the length of the sixth, and twice as long as the second. The anterior spines are much compressed, and are stronger than the posterior ones, which after the fifth become perceptibly more and more slender; all are slightly curved backwards. The soft rays are scarcely taller than the last spinous one to which they closely adjoin, and they diminish but little in length towards the end of the fin. The anal is short and triangular; its first spine is very short; its second is nearly half the length of the soft rays, and is stronger and as long as the third spine, which it receives into its posterior groove. The position of the fin is under the middle of the articulated dorsal, than which it is much higher, the length of its soft rays being equal to those of the ventrals. The bases of the pectorals are covered with small scales. The dorsal shuts into a groove formed by a scaly fillet on each side, and lines of minute scales extend nearly to the tips of the caudal rays.

Scales.—The head is covered with small scales, except the snout anterior to the nostrils, the first suborbitar, the jaws, branchiostegous membranes, and edge of the gill-cover. A very small cluster of minute scales marks the site of the supra-scapular bone, and the breast is covered by small scales. The scales of the body are moderately large, and have thin membranous edges, without teeth on the margins or surface, but the base of each scale is impressed by four or five short furrows with corresponding crenatures. There are about sixty-eight scales in a row to the base of the caudal. The lateral line is slightly arched anteriorly, and is most distant from the dorsal profile near its commencement, though even there it is twice as far from the rim of the belly. In running backwards it gradually approaches the back, and comes nearest to it at the end of the soft dorsal; but in continuing onwards to the base of the caudal it recedes from the upper outline of the tail. When the skin of the fish is held between the eye and the light, the lateral line appears to be a continuous tube, from which short branches pass off obliquely upwards, one to each scale. These simple branchlets alone are seen when the fish is entire: there are about sixty-six of them.

Colour.—The true colours can no longer be detected in the specimens, but the dried skins exhibit a dark belt that runs downwards and backwards over the eye and gill-cover to the base of the pectoral, where it meets another descending from the nape over the edge of the gill-flap. A broader band takes in the three first short dorsal spines, and passing obliquely backwards and downwards, tapers away on the side beneath the middle of the pectoral. A black patch includes the fifth and seven following spines, and from it a stripe extends backwards under the base of the dorsal to the tail. There are indistinct vestiges of small spots on the caudal. Parkinson's neat pencil drawing of the Endeavour River fish shows a black bar crossing the snout before the nostrils and two between the eyes which meet on the cheek, and running onwards to the pectoral, are there joined by the nuchal stripe, forming by their union a single band, which is continued backwards to the ventrals. The band from the three short dorsal spines is exactly as in Mr. Gould's specimens; but the broader one behind it commences near the tip of the third and highest dorsal spine and passes over all the succeeding rays to the tenth, whence it is continued as described to the lower lobe of the caudal.

Dimensions.

	Inches.	Lines.
Length from intermax. symphysis to tip of tail	13	6
Length from intermax. symphysis to tips of central caudal rays	12	0
Length from intermax. symphysis to base of caudal	10	10
Length from intermax. symphysis to end of soft dorsal	9	8
Length from intermax. symphysis to end of anal	7	7
Length from intermax. symphysis to beginning of anal	6	4½
Length from intermax. symphysis to anus	5	10
Length from intermax. symphysis to ventrals	3	8
Length from intermax. symphysis to tip of gill-flap, or to pectorals	2	6½
Length from intermax. symphysis to beginning of dorsal	2	3
Length from intermax. symphysis to centre of orbit	1	4
Diameter of orbit	0	7½
Greatest depth of body (under the fourth dorsal spine)	3	3
Height of first dorsal spine	0	3½
Height of third dorsal spine	0	7½
Height of seventeenth dorsal spine	0	10½
Height of sixth dorsal spine	1	11
Height of fifth dorsal spine	2	3
Height of fourth dorsal spine	2	7
Height of anterior soft rays	0	10½
Height of second and third anal spines	0	9
Height of soft rays of anal	1	7½
Length of ventrals	1	9½
Length of longest simple pectoral ray	3	3
Length of adjoining ray above or below	2	3
Length of caudal lobes	3	0
Length of central caudal rays	1	2
Depth of caudal fork	1	3
Length from soft dorsal to base of caudal	0	10¾
The dorsal passes the anal about	2	3
Breadth of snout at maxillary projections	0	2½

LATRIS HECATEIA (Nob.), *Six-banded Latris* (*Trumpeter*[1]).

Latris hecateia, Richardson, Zool. Proceed., June 25, 1839.

Tab. VI. Fig. 1.

The *Sparoideæ*, as restricted by Cuvier, are distinguished from other *Acanthopterygii* by their oval form, an undivided, scaleless dorsal, a preoperculum devoid of serratures or teeth, a spineless operculum, toothless vomer and palate, branchiostegous rays not exceeding five or six, and pyloric cæca few in number (from four to seven). The *Mænoideæ*, comprising, in the 'Histoire des Poissons,' only four genera, resemble the *Sparoideæ* in their general organization, but differ from them in some particulars of structure. Thus *Mæna*, the typical genus, has, like the *Percoideæ*, teeth on the vomer; *Cæsio* has the dorsal clothed with small scales like many of the *Sciænoideæ*; *Gerres* has a denticulated preoperculum, and two scaly fillets running along the ridge of the back to form a groove for the reception of the dorsal fin; while *Smaris*, in common with the other three genera, has a protractile mouth. This last character is the one which most readily distinguishes the group from the *Sparoideæ*, or as Cuvier says, "*Heureusement qu'il existe un caractère propre à détacher ces genres rebelles de la famille des Spares, sans les séparer les uns des autres: c'est la protractilité de leur museau: et nous n'avions point hésité à employer cette conformation comme base d'une famille particulière celle des Ménides.*" The same power of thrusting out a tubular mouth is possessed in an eminent degree by the *Dories*, and more especially the *Equulæ* of the scomberoid family, and by the labroid *Epibuli*. Some *Percoideæ* also have long intermaxillary pedicles, and consequently can protrude the mouth, but not so much in form of a tube with a circular orifice, because the membrane connecting the upper and lower jaws is narrower and less elastic. The *Mænoideæ* differ from all the *Sparoideæ*, except the *Canthari*, in the whole of their teeth being villiform; but they resemble most of the members of that family in having an elongated scale on each side of the ventral fins and one between them, resembling also in this respect the *Salmon* and *Herrings*. This character is so remarkable in the sparoid genus *Pentapus*, as to have given origin to its name.

These observations have been mostly extracted from the 'Histoire des Poissons,' for the purpose of rendering the peculiarities of the Van Diemen's Land fish, which forms the proper subject of this article, more apparent. In placing this fish (which I have named *Latris hecateia*) with the *Mænoideæ*, I have been guided in a considerable degree by external characters; for I could not ascertain the form of the air-bladder or the osteology, without sacrificing the only specimen I possessed. The mouth, though protractile, is less so than in *Mæna*, which *Latris* resembles in form of body and dentition more than it does the other three genera of the group, the arrangement of the teeth

[1] Since this paper was read before the Society Mr. Gould has returned from Australia, and on being shown the figure of this fish, he recognised it as the 'Trumpeter' of the colonists, one of the most highly prized fishes taken in the Australian seas.

being in fact almost identical with that exhibited by *Mæna vomerina*. There is a groove on the back formed by two scaly fillets for the reception of the dorsal fin as in *Gerres*; the fin itself is very deeply notched between its spinous and articulated portions; the preoperculum is minutely and obscurely crenated or quite entire, the operculum terminates by a slightly concave line, without projecting points, and the suboperculum passes beyond it in a narrow flexible tip, which forms the extremity of the gill-cover. The suborbitar is quite entire; the head is scaly on its upper surface as far forward as the nostrils, but on its sides the scales are distributed as in the other *Mænoideæ*. The ventrals are still farther back than in *Cæsio*. The cæca are few, as in the *Sparoideæ* in general. None of these characters are foreign to the *Mænoideæ* as a group, yet they do not exist so combined in any established genus, and *Latris hecateia* exhibits in addition some particulars of structure not to be found in any described mænoid fish:—viz. scales having even edges without teeth or cilia, and in fact perfectly cycloid; no elongated scales at the ventrals; and simple lower pectoral rays projecting slightly beyond the membrane. The simplicity of the pectoral rays is considered by Mr. Gray to be of sufficient importance to constitute the basis of a family group, and Baron Cuvier never ranks it lower than as a generic mark. It occurs most frequently, and in the greatest variety of form, in the cottoid family, is common among the *Gobioideæ*, and characterizes several percoid and sciænoid genera; but until the discovery of *Nemadactylus* and *Latris*, it was not known to exist in any group connected with the *Sparoideæ*, *Mænoideæ*, or *Scomberoideæ*. It appears to be a peculiarity of structure not uncommon among the fish of Van Diemen's Land.

A small aberrant percoid group, the *Theraponini*, comprising the genera *Nandus*, *Therapon*, *Datnia*, *Pelates*, and *Helotes*, approaches the *Mænoideæ* in several characters. Thus in *Nandus* the percoid characteristic of armed gill-covers is reduced to the mere vestige of a point on the operculum, and in *Pelates* to two points so feeble as to be scarcely perceptible, while the preoperculum is not more serrated than in the mænoid *Gerres*. None of the group have more than six branchiostegous rays, and *Pelates quinquelineatus* has only six pyloric cæca, these appendages being altogether wanting in *Nandus* as in the *Labri*, while the air-bladder is simple and the jaws protractile as in the *Mænoideæ*. The rest of the members of the group have the air-bladder divided in the middle by a contraction like the *Cyprinoideæ*, *Characini*, and *Myripristes*; but in the *Mænoideæ* this viscus has a simple body, though in many instances it gives out posteriorly two horn-like processes. The scales of the *Theraponini* are ciliated as in the *Mænoideæ*; but none of them have the long scales at the base of the ventrals, which occur in all the *Mænoideæ* except *Latris*. In both groups the prevailing distribution of the darker colours is in longitudinal stripes, which is the case also with *Latris hecateia*, and both its generic and specific names were in fact suggested by the resemblance which it has in this particular as well as in others to the *Theraponini* and *Mænæ*; Λάτρις, *serva vel ancilla*, being nearly similar in signification to *Therapon*, *Helotes*, and *Dules*; and as the Mediterranean fish which was termed Μαινὶς by the ancients (whence

Mæna) was sacred to Diana in the character of Hecate, the name of the Port Arthur fish, *Latris hecateia*, i. e. *Ancilla Hecates*, is intended, by its allusion to that fact, to indicate its affinity to the *Mænæ*.

The genus *Apsilus*, placed by the authors of the 'Histoire des Poissons' among the Percoids with a single dorsal fin, resembles *Latris* in the absence of denticulations or spines of any kind on the bones of the gill-plates or shoulder. *Apsilus*, however, has ciliated scales, palatine teeth, and branching rays in the lower part of the pectoral, which distinguish it abundantly from *Latris*. The resemblance of *Apsilus fuscus* to *Cæsio*, and the sparoid family generally, pervades the whole account of it in the 'Histoire des Poissons.' The following is a summary of the generic characters:—

LATRIS, genus novum.

Piscis acanthopterygius, mænoideus. *Pinnæ* (præter caudalem) esquamosæ; pinna unica dorsi, profundè emarginata, in fossâ decumbens: pinnæ ventrales sub abdomine medio positæ: radii pinnæ pectoralis inferiores (novem) simplices nec tamen producti. *Preoperculum* denticulatum vel integerrimum. *Os* modicè protendens. *Dentes* villosi in oris ambitu positi tignoque vomeris ubi decidui; in ossiculis pharyngeis parvi, subulati, conferti. *Palatum linguaque* læves. *Squamæ* marginibus lævissimis.

L. hecateia, species unica probè cognita.

Radii.—Br. 6 — 6; P. 9 et IX.; V. 1|5; D. 18|36; A. 3|27; C. $16\frac{6}{6}$.

Since the preceding remarks on the characters and affinities of this fish were read to the Society, I have studied the account of the *Cheilodactyli* in the 'Histoire des Poissons' with more attention, and I am now satisfied that *Latris* is very closely allied to *Cheilodactylus*, not only in general structure and in the forms and integrity of the opercular pieces, but also in the minor agreement of the rays of the dorsal being more numerous than in most percoid or sciænoid fishes. I have, however, allowed the preceding remarks to remain unaltered for the purpose of explaining the origin of the generic and specific names, and also because I am not satisfied that *Cheilodactylus* is in its proper place when ranged in the sciænoid family. Mr. Gray's suggestion above alluded to is worthy of attention, or at least *Cirrhites*, *Cheironemus*, *Aplodactylus*, *Cheilodactylus*, *Latris*, and *Nemadactylus* may be grouped into a small family, which will take a place intermediate between the *Mænoideæ*, *Sciænoideæ*, and *Percoideæ*. These genera are remarkable, in the groups in which they at present stand in the systems, for the elongation of the pelvic bones and the consequent backward position of the ventrals, the want of palatine teeth, the unarmed condition of the gill-covers, the small number of the pyloric cæca, and the simplicity of the lower pectoral rays. In *Cirrhites* the vertical limb of the preoperculum is denticulated; but even this approach to the percoid or sciænoid armature of the opercular pieces is inconspicuous, or altogether wanting in the other genera above-mentioned. The whole group wants revision; the anatomical structure of the species being less fully detailed than is usual in the 'Histoire des Poissons,' evidently from the scarcity of specimens, and the difficulty of procuring them in good condition from the southern ocean. In like manner as Australia is the chief abode of the pouched quadrupeds, which are represented in South America and the Indian isles by less typical forms, so the Australian sea appears to be the principal resort of the group of fish in question, though some species inhabit the Indian Archipelago, the coasts of Chili, and even other districts of the ocean.

With regard to the rank of *Latris*, it may be considered, according to the different views of systematic ichthyologists, either as a generic group, or as a subdivision or subgenus of *Cheilodactylus*, characterized by the deeply divided dorsal and by the rounded form of the pectorals, none of the simple rays being thickened or elongated.

Since I drew up the subjoined account of the external characters and intestines of a single example of *Latris hecateia*, I have received two other specimens of *Latris* from Mr. Lempriere which present some differences, but as they are not in good order, I cannot decide whether they are actually of the same species or not. Their rays are P. 9 and IX., or 10 and VIII.; D. 16|40, the last deeply divided; A. 3|34. The preoperculum is quite entire, and no traces of bands of colour remained on the body. It is from these two examples that the osteology is described below.

Description.—Form much compressed. The outline of the back throughout the space occupied by the spinous dorsal, or about one-third of the length of the fish, is quite horizontal; from thence the profile descends with a slight concavity to the snout, whose extremity is on a level with the lateral line. The inferior profile is a flat curve from the tip of the lower jaw to the tail. The portions of the profile occupied by the anal and soft dorsal curve in an equal degree to join the moderately slender tail, which lies in the middle of the vertical height of the fish. The back is acute, the belly less so. The body is highest at the ventrals, its height there being just one-third of the length of the fish, excluding the caudal; its greatest thickness equals one-third of the height, and occurs below the lateral line about midway between the back and belly. The lateral line runs perfectly straight from the supra-scapular to the middle of the caudal fin, at between one-third and one-fourth of the whole depth from the back. It contains 114 scales, smaller than those of the adjacent rows, and each furnished with a tubular ridge, which becomes narrower and is bent upwards as it approaches the posterior margin of the scale. The scales of the body are of moderate size, and when *in situ* have a neat, compact appearance; their discs, forming small vertical rhombs, are roughened by minute granulations of the epidermis, but the margins are smooth. A scale, when detached, is seen to be five-sided, presenting anteriorly three sides of a square, the basal one being marked by about six parallel grooves which do not reach the centre. The posterior or exposed portion has an irregularly triangular outline, with very delicate smooth margins, and dots on the discal epidermis which look like pores when examined through a microscope. The lines of structure in some scales surround a square dotted centre, in others their disposition is oblique. The scales on the top of the head, and on the moveable fillets that form the dorsal groove, are very small. A ring encircling the anterior part of the body contains eighty scales, of which fifteen on each side are above the lateral line, and twenty-four below.

The head, when the mouth is closed, has a conical profile, with its upper line slightly concave, the lower one rather convex, and the under jaw sloping upwards. Its length, measured to the tip of the gill-cover, is comprised four times in the total length of the fish, caudal included; its transverse diameter increases from the snout to the nape, where it equals that of the body at the pectorals; between the eyes it is flatly rounded, but on the nape it rises into an acute edge; and it thins off gradually from beneath the eye to the slender isthmus of the gill-openings. The perfectly round and rather small eye is situated near the upper profile, and at an equal distance from the tip of the snout and gill-opening; its diameter is contained thrice and one-half in the length of the head, and fully thrice in its height at the orbit. The distance between the orbits rather exceeds the width of the eye. The nostrils are about one-third nearer to the eye than to the tip of the snout; the posterior opening is small and round, the anterior one larger, oblong, and having its hind margin raised. The first suborbitar bone, situated directly before the eye, is rather large, and has a rhomboidal form, its posterior edge being a little shorter than the others: its surface is smooth, nacry, and scaleless, with two or three smooth branching tubes not showing until the epidermis dries; none of its margins are toothed, though the under one is slightly undulated. A narrow edging of smooth skin surrounds the orbit, and a smooth space extends from it over the first suborbitar to the snout. A second and third suborbitar, thin and narrow, are concealed by the scaleless integument.

The limbs of the preoperculum meet at a right angle, the corner being broadly rounded off. When the integument is scraped off, its perfectly even and nearly membranous margin is discovered to be supported by a series of very slender short ridges inclining upwards, but too minute to be distinctly seen without the aid of a lens[1]. The anterior side of the operculum is the longest, the inferior one is next in length and is convex, the posterior one is slightly concave with rounded corners, and the upper one is the shortest of the four. The suboperculum is narrow and tapers posteriorly, its membranous tip projecting a little beyond the operculum. The interoperculum is broad with an evenly convex lower edge. The cheeks and operculum are covered with scales considerably smaller than those of the body; the scales of the preoperculum, suboperculum, and interoperculum are still smaller, those of the latter being very minute as they approach its under edge, near which they altogether disappear. The scales of the upper part of the head terminate at the nostrils by a rounded outline. The narrow membranous edging of the gill-cover, the bones of the humeral chain, and the axilla of the pectoral fin are smooth and scaleless; but the base of the pectoral anteriorly is scaly. There are no peculiar supra-scapular scales.

[1] The left preoperculum has an obtuse notch where the sinuation usually occurs in *Diacope*; but this appears to be accidental, as the right preoperculum is quite entire, and there is no projecting knob of the suboperculum.

The gill-opening is wide, the isthmus beneath the tongue very narrow, and the limbs of the lower jaw do not overlap the membrane, but are even with it.

The jaws are moderately protractile, the intermaxillary pedicles equalling the dental limbs in length, and allowing the latter to be protruded half an inch. The maxillaries are somewhat longer than the intermaxillaries, and widen towards their lower ends which are truncated, and just touch the orifice of the mouth when opened to its greatest extent. They do not retire beneath the edge of the preorbitar when the jaws are closed. The lower jaw can be depressed below the horizontal line, and it then forms one-half of the circumference of the mouth. The oral orifice is oval, with the long axis vertical. The lips are moderately thick. There are no scales on the snout or jaws anterior to the nostrils. There is a transverse membranous velum immediately behind the teeth of the upper jaw, and the tongue is pretty prominent. The inside of the mouth has a purplish black colour.

The teeth, small, curved and acute, are disposed in fine villiform plates on the intermaxillaries and lower jaw, the dental surface being narrow throughout, though widest at the symphysis of the jaws. The chevron of the vomer projects in form of a smooth black pad, with a small circular patch of minute teeth in the centre: the tongue is smooth. The pharyngeal teeth are small, awl-shaped, and densely crowded, implanted on very convex plates above and on flat ones below; the anterior rows of the former and the interior ones of the latter being somewhat longer and very sharp. The outer branchial arch supports a row of awl-shaped, compressed rakers, two lines and a half long, and armed interiorly with very fine hair-like teeth. The same arch has an interior row of sessile knobs, and the other arches have two rows of knobs, all strongly bristled with short teeth.

The branchiostegous rays are thin and flat; the membranes narrow. The pectoral fin is supported by eighteen jointed rays, the nine lowermost and two uppermost ones simple, the six intermediate ones forked. The outline of the fin is rounded; the tenth and eleventh rays are the longest, and, together with those beneath, project a little beyond the membrane. The scales on the base of the fin form a semicircular patch. The ventrals are pointed and rather small, the first soft ray being the longest, and having about twice the length of the slender spine; they are situated under the posterior third of the pectorals, or opposite to the ninth dorsal spine. The space between them is clothed with small scales, and there are no elongated scales in their axillæ. The dorsal commences over the tip of the gill-cover, and runs backwards to very near the caudal fin. Its spinous portion, supported by eighteen rays, has a boldly arched outline, the seventh spine being the tallest and four times as long as the first and seventeenth, which are the shortest: the eighteenth spine is a little longer than the one which precedes it, and is closely applied to the first articulated ray. The membrane is notched between the spines, but a small filament runs up to the tip of each spine. The soft portion of the fin nearly equals the spinous one in length, and is highest anteriorly, where it equals the tallest spine. The outline of the fin throughout is slightly convex, the rays diminishing posteriorly, so that the last one has only one-third of the length of the first one. The whole fin moves in a furrow formed by longitudinal scaly fillets, separated on each side from the back by a fine groove. The spinous part of the dorsal folds entirely into the furrow, but the soft part cannot be so completely hidden.

The anal fin commences opposite to the twelfth articulated ray of the dorsal, and terminates opposite to the last ray of that fin, leaving but a short naked tail. It is supported anteriorly by three short spines; its soft rays are longer in the anterior part than any of the dorsal ones, and the outline of the fin is straight, with the foremost corner rounded off. The anal furrow is less deep than the dorsal one. The caudal is very much forked, and the incumbent rays of its base augment the vertical height of the tail considerably. Double rows of small scales run out between the rays for two-thirds of their length. There are no scales on the membranes of the dorsal or anal.

The colours of the specimen have doubtless faded from the action of the spirit in which it has been kept, but there are still some orange tints perceptible on the fins. There are also three dark longitudinal stripes on each side of the back, nearly meeting in the upper part of the tail, and continued forwards on the head to the eye and suborbitar in a series of undulating lines and blotches. The upper band adjoins the dorsal fillet, and the lower one is on a level with the eye; they are separated by clear spaces equal in breadth to themselves. A broader band is less distinctly marked behind the pectoral fin. The rest of the side is light, but there are some dark markings on the border of the gill-opening.

Intestines.—Liver moderately large, with a squarish body, from which three long, pointed, triangular lobes project, one of them smaller than the other two. Peritoneum of a blackish hue. Air-bladder large, but so much torn in the specimen that its form could not be ascertained. Descending part of the stomach moderately wide, ending obtusely, and giving off a little above its middle a pyloric branch of half its diameter, and not above a sixth of its length. A valve is formed at the pylorus by a smooth projection of the inner membrane. Four wide cæca surround the intestine at its commencement, the longest measuring about one inch in length, and the shortest about half as much. Beneath the cæca the gut dilates, and its inner coat is reticulated by small plaited folds, which soon disappear. A circular valve projects into the rectum, which is somewhat wider than the superior part of the alimentary canal, and is faintly reticulated.

Osteology.—Described from two specimens preserved in salt. The pedicles of the intermaxillaries are about one-fourth longer than their dental limbs. The bones of the head have no traces of cavernous structure; the top of the cranium is smooth and convex transversely. The lateral ridges of the occiput are conspicuous enough, from the depressions of the bone above and below them; but the mesial ridge, though considerably shorter, is more elevated. The posterior edge of the operculum is straight and even, or scarcely perceptibly sinuated. A single interspinous bone, which is thickest at its summit, and is not connected with a ray, intervenes between the occipital ridge and the first spinous process of the vertebral column. The next interspinous bone touches the same spinous process posteriorly, and supports the first dorsal spine. The numbers of the dorsal rays and their interspinous bones correspond pretty exactly, but the soft dorsal has anteriorly two and posteriorly three interspinous bones between each pair of spinous processes. The spinous dorsal has for the most part a single ray to each spinous process, though its spines are more crowded anteriorly. There are in all thirty-four vertebræ, all furnished with rather slender superior spinous processes, which increase slightly in length from the first till the tenth; the five following ones are nearly of the same length, after which they again diminish successively, the posterior caudal ones being very short and weak. The superior oblique processes of the anterior vertebræ form thin ragged crests, which reach from one spinous process to the next one, but posteriorly to the tenth vertebra these crests are more restricted, and gradually assume the ordinary form of short oblique processes. The transverse processes of nine of the vertebræ show pits for the heads of the ribs, which are large and cup-shaped in the first six, but are more oblique and less conspicuous in the three following ones. The tenth and four following transverse processes are united to their fellows by a bridge of bone, which leaves their forked tips projecting, and encloses at the base a small round hole for the transmission of vessels. The fifteenth, which may be considered as the first caudal vertebra, has a simple inferior spinous bone, shaped like the nib of a writing-pen, with a fine, tapering point. The strong interspinous bone at the commencement of the anal fin is connected to the point of this nib, and also rests against the tips of the two succeeding inferior spinous processes, which recline backwards, are the longest of the series, and exceed the pen-shaped one in length by one-third: the more posterior ones become successively shorter, like the superior spinous processes.

Dimensions of a Specimen preserved in spirits.

	Inches.	Lines.
Length from the tip of the snout (retracted) to the tip of the tail . .	11	0
Length from the tip of the snout (retracted) to beginning of caudal fin .	9	0
Length from the tip of the snout (retracted) to end of dorsal or anal .	8	0
Length from the tip of the snout (retracted) to first spine of anal . .	6	1
Length from the tip of the snout (retracted) to anus	5	10
Length from the tip of the snout (retracted) to 17th spine of dorsal .	5	4
Length from the tip of the snout (retracted) to ventrals	3	10
Length from the tip of the snout (retracted) to first dorsal spine . .	2	6
Length from the tip of the snout (retracted) to tip of gill-cover . .	2	6
Length from the tip of the snout (retracted) to orbit	1	0
Height of body at the ventrals	3	0

	Inches.	Lines.
Thickness behind the shoulders nearly	0	5
Length of pectorals	1	8
Length of ventrals	1	2
Height of seventh dorsal spine	1	0
Height of highest part of anal	1	0
Length of a caudal lobe	1	10
Depth of caudal fork	1	0
Vertical diameter of the mouth	1	0
Length of dental limbs of intermaxillaries	0	8
Length of pedicles of ditto	0	9
Length of descending part of stomach from the gullet	2	4
Length of pyloric branch	0	5
Length of small gut	5	6
Length of rectum	1	6
Length of largest pyloric cæcum	1	0

The Banksian collection of drawings, made during Cook's first two voyages, contains four figures of New Zealand fish, having the generic aspect of *Latris*. The first in chronological order is the *Sciæna salmonea*, pl. 66. no. 19. of Parkinson, and represents a fish which inhabits Totæranue, a cove within the island of Motuaro in Queen Charlotte's Sound. The figure is an unfinished pencil sketch, exhibiting the general form of *Latris*, but the details are not sufficiently made out to enable us to assign the systematic place of the fish with confidence. The dorsal fins are contiguous, the first containing fifteen strong spines, the third and fourth of which are the tallest, and the last one very short; the number of rays in the second fin is not indicated, nor is it shown whether it commences with a spine or not. The ventrals are attached beneath the posterior third of the pectorals, and the caudal is forked.

The next figure is by George Forster, and is entitled *Sciæna lineata* (vol. ii. pl. 204.). It represents a fish which was taken in Dusky Bay, and Schneider (p. 342) has published a short account of it from J. R. Forster's manuscripts, under the head of *Cichla lineata*. This description agrees so well, as far as it goes, with the Port Arthur Trumpeter, particularly in the distribution of the alternate light and dark stripes and in the numbers of the fin rays, that I should have considered them to be the same species, had the figure not indicated a fish with a larger mouth, more conspicuous teeth, and a somewhat different physiognomy. Only fourteen or fifteen dorsal spines are shown in the sketch, but the following are the numbers mentioned by Schneider, expressed in the modern notation: Br. 6; D. 18|36; A. 1|26; C. 30; P. 17; V. 1|5. Forster states that the fish frequents rocky places, delighting in narrow straits between two cliffs; and that the sailors caught it with a hook and named it 'yellow tail.' Its length was two feet, its height seven inches, and its flavour, when cooked, agreeable. Should it prove, on a comparison of examples from Van Diemen's Land with others from New Zealand, that the figure is incorrect, and the species the same in the two localities, the appellation *hecateia* must give place to the much older one of *lineata*.

The other two figures are also by George Forster, and are both inscribed *Sciæna ciliaris*. One of them (pl. 204.) is the most finished of the four drawings here referred to, and is the portrait of a fish which inhabits Dusky Bay, where it is named 'Moghee' by the natives. The back, top of the head and fins are bluish black, the sides azure, the belly white, and the temples and cheeks speckled. The preoperculum appears to be serrated. Though the figure is differently coloured from the Trumpeter, and wants the lateral stripes, it represents the general aspect and proportions of this fish better than any of the other three figures, and I have little hesitation in considering it as a species of *Latris*, notwithstanding that Schneider, who quotes Forster's account of the fish, under the head of *Anthias ciliaris*, mentions two characters which do not exist in the Port Arthur examples of the genus, viz. a keeled belly, and two ciliated tubercles over the eyes. The rays of *Latris ciliaris*, enumerated in Schneider, are D. 16|—1|42 ; A. 2|36 ; C. 30 ; P. 20 ; V. 1|5. The last spine of the first part of the dorsal is stated to be only half the length of the spine at the beginning of the second part. The length of the individual (which seems to have served both for the description and drawing) was $9\frac{1}{4}$ inches, its height 3 inches.

The fourth figure (pl. 209.) is a mere pencil outline of a fish taken in Queen Charlotte's Sound on the 25th of October 1774, and its being also entitled *Sciæna ciliaris* seems to be a proof that it was considered at the time to be the same species with the preceding. The preoperculum is more distinctly serrated. The length of the specimen was seventeen inches.

Nemadactylus concinnus (Nob.), *Silvery Threadfinger.—Nemadactylus concinnus*, Richardson, Zool. Proceed., June 1839.

Tab. IV. Fig. 2.

In the collection first despatched by Mr. Lempriere there was a single specimen of a small fish, which agrees with the genera commented upon in the preceding article in the simplicity of the lower pectoral rays, and particularly with *Cheilodactylus* and *Cheironemus* in one of these rays being lengthened out beyond the rest, as well as in the dorsal rays being numerous; but it is abundantly distinguished by its very feeble dentition, the perfect smoothness of the roof of the mouth and fauces, and the want of scales on the cheeks and gill-covers, which latter are totally unarmed. The small number of branchial rays, and the scomberoid character of the scales are additional peculiarities. In the extreme thinness of the scales, their cycloid structure, the elevation and silvery aspect of the row which clothes the lateral line, and the entire want of points or serratures on the opercular pieces, combined with the largeness of the gill-openings, *Nemadactylus* may appear to be allied to the third or fourth group of scomberoid fishes, as established in the 'Histoire des Poissons'; but it is separated from them by the simplicity of the pyloric cæca or pancreatic apparatus.

Cheilodactylus carponemus has cycloid scales of rather large size and thin texture, and, judging from the descriptions of the other species by Messrs. Cuvier and Valenciennes, they, as well as *Cheironemus*, depart from the normal characters of their respective families in this also, as well as in other peculiarities noticed in the preceding article. *Nemadactylus* differs still more than these from the percoid or sciænoid families in the extreme delicacy of its scales, and would appear to be further excluded from the latter by the absence of any appearance of cavernous structure in the cranial bones; but as Cuvier has in several instances dispensed with this character, and has also admitted *Glyphisodon*, *Atroplus*, and *Heliases* among the *Sciænoideæ*, although their gill-covers are unarmed, some naturalists may be inclined to consider that *Nemadactylus* ought to be ranked in that family also, in which case it will stand in the analytical table of genera after *Cheilodactylus*; that is, among those which have a single dorsal, fewer than seven branchial rays, a continuous lateral line, and some simple rays projecting beyond the membrane of the pectoral fin. It may, however, be found more convenient to place these aberrant genera in a separate group, as suggested in the remarks upon *Latris*.

Fragments of small *Malacostraca* were found in the intestines of the specimen described below; but I have no information respecting its habits, and can only conjecture that it may be the 'Silver-fish' standing No. 15 in Mr. Lempriere's list.

Nemadactylus, genus novum.

Piscis acanthopterygius. *Operculum* læve, inerme. *Pinnæ, genæ temporaque* esquamosæ, in dorso pinna unica. *Radii* pinnæ pectoralis inferiores (sex) simplices, quorum unus crassior, productus. *Costæ branchiostegæ* paucæ (tres). *Intermaxillarum* pedunculi breves. *Dentes* gracillimi, minuti, in ambitu oris unâ serie tantum positi. *Fauces, palatum, vomer* et *lingua* glabri. *Squamæ* teneræ, leves, infràque lineam lateralem vix aut ne vix a cute dignoscendæ. *Cæca* pylorica pauca (tria vel quatuor). *Vertebræ* circa 34.

N. concinnus species unica adhuc detecta.

Radii.—Br. 3 — 3; P. 9 et VI.; V. 1|5; D. 17|28; A. 3|15; C. $15\frac{6}{6}$.

Form.—Much compressed; the profile broadly elliptical or ovate; the curve of the back and belly similar, ending in a short tail, whose depth is about one-fourth of that of the body. The body is deepest between the ventrals and fifth dorsal spine, where its height exactly equals one-third of the total length, excluding the caudal fin. It is thickest at the lateral line close to the shoulder, its transverse measurement there being equal to the fourth of the depth; the sides are much compressed below; the belly has an acute edge, which continues so to the caudal fin; and though the back is rounded off above the lateral line, it also terminates in an acute ridge. The vent is midway between the snout and tips of the central caudal rays. The head, measured to the gill-opening, forms nearly one-third of the whole length; when viewed from above, it is seen to increase gradually in thickness from the very narrow snout to the shoulder, having a transversely convex surface from the nostrils to the nape, and a smooth, acute, mesial ridge between the nape and first dorsal spine. The nostrils consist of two small openings near each other, and close to the orbit. The moderately large eye, situated midway between the tip of the snout and the upper angle of the gill-covering, occupies about one-third of that space. The orbits approach close to the profile of the head, without altering its lines, and the space between them is equal to the diameter of the eye.

The mouth is small, its gape scarcely extending half way to the eye; lips tumid; intermaxillaries moderately protractile, the labial sliding entirely under the infra-orbitar when the mouth is shut, but exposed for its whole length when the jaws are extended. The teeth, minute and slender, stand in a single row on the intermaxillaries and lower jaw, but they cannot be readily seen without the aid of a microscope. The palate and vomer are toothless, and are lined by a dark-coloured membrane, which is longitudinally plaited towards the gullet, and is crossed at the knob of the vomer by a crescentic velum. The tongue is smooth, and has little liberty. Each limb of the lower jaw is perforated by four pores, and its thin expanding inferior edge can approach its fellow so as to overlap the isthmus of the branchiostegous membrane. The preorbitar is quadrilateral, with the anterior corners rounded. If there be a chain of infra-orbitars under the eye, they are so thin that they cannot be distinguished from the nacry skin.

The gill-covers, composed of very thin smooth bones, devoid of spines, serratures, ridges, or grooves, are covered like the cheeks and side of the head by a thin nacry skin, in which no scales can be detected. The preoperculum is broad, with a very thin, entire, posterior edge, its corner rounded, and the two limbs diverging at a right angle. Interoperculum also broad and large, forming a slightly angular corner beneath, at the junction of its curved inferior and posterior margins. Suboperculum having a narrow strap-shaped form, its membranous tip protruding slightly at the apex of the gill-cover. Operculum cut away posteriorly, in a line which is scarcely concave, and leaves no projecting corners; its membranous edging is narrow. The gill-openings are large. The branchiostegous membrane is narrow, and much concealed under the projecting edge of the interoperculum; and the rays, three in number, are short. There are no pharyngeal teeth, some minute points only being discernible by the aid of a lens at the junction of the branchial arches beneath. The exterior arch is furnished with a row of moderately long, slender, awl-shaped rakers; on the other arches there is merely a series of little knobs, each armed with about three diverging hair-like teeth.

Scales.—The upper surface of the head is clothed with delicate small scales, which terminate in a point between the nostrils, the rest of the head being either quite naked or merely covered with nacre. The body above the lateral line is also scaly; the scales, though larger than those on the head, being still small, very thin, and firmly imbedded in the skin. The lateral line is formed by fifty shining nacry scales, raised above the surrounding integuments, and is bounded superiorly by a grove: these scales, though more conspicuous by their lustre, are not larger than the others, and are each furnished with a tubular elevation, which turns upwards towards its termination, becoming also more slender. Beneath the lateral line the integuments are wrinkled, as if they covered large scales; but if such scales do actually exist, they are so delicate as not to be distinguishable from the nacry epidermis. The structure of the scales is cycloid, with about eight furrows on the base, producing as many marginal crenatures, but not reaching to the centre.

The coracoid bone (humeral of Cuvier) terminates above in an acute point, which may be made to project at the lateral line; and the lower end of the bone, where it meets its fellow, forms a small angular projection beneath the gill-opening. The second bone in the scapular chain lies like a large scale before the point above mentioned.

Pectoral fin large, all its rays slender, the nine upper ones forked at the tips; the tenth simple, thicker and longer than the others, and projecting nearly one-fourth of its length beyond the membrane; the five inferior ones also simple, more slender, and scarcely passing the membrane. Dorsal commencing over the pectorals, its spines firm and acute, gradually shortening from the sixth, which is the longest, rendering the outline of that part of the fin arched. The soft part of the fin commences opposite to the anus; its first ray, which is soft and flexible at the tip, but does not appear to be jointed, is equal in height to the last spine; the second soft ray equals the fifth or seventh spine, the others becoming gradually shorter, so that the edge of the fin is straight, not arched; the two posterior ones are short, and forked at the tips, all the rest being nearly simple. Ventrals small, far back, opposite the eighth dorsal spine, and midway between the anus and gill-opening. Anal having three short acute spines, rather stouter than the dorsal ones. This fin does not extend so far back as the dorsal, and its attachment occupies as much space as the distance between its last ray and the caudal. The caudal is deeply and acutely forked; its lobes equal.

Anatomy.—The œsophagus is wide and short. The stomach descends from its cardiac orifice, which is a little narrower than the œsophagus, in a nearly cylindrical form, terminating in an obtuse cone; the pyloric branch, one quarter as long, goes off at a right angle, leaves the obtusely conical cul de sac beneath it, and contracts gradually towards the pylorus. Three very short conical cæca surround the gut immediately below the pylorus, and a little further from it there is a fourth cæcum, larger than the others, and so placed as to appear like a cæcal head of the canal of the gut, the pyloric branch of the stomach opening, as it were, into the side of the intestine. The gut makes one complete convolution and then descends to the anus. The liver appeared to be of small size, but was too much bruised to permit its form to be seen. Air-bladder[1] cylindrical in the middle, obtuse above, tapering to a fine point below, and extending about half way down the abdomen. Peritoneum blackish.

The pelvis is connected to the symphysis of the coracoid bones by a long triangular bone, whose inferior edge is thin and expanded vertically. The vertebræ are thirty-four in number, twenty-one of them being posterior to the first ray of the anal fin.

Dimensions.

	Inches.	Lines.
Length from tip of snout to tip of caudal fin	3	8
Length from tip of snout to base of caudal	3	0
Length from tip of snout to anus	1	9
Length from tip of snout to beginning of ventrals	1	2½
Length from tip of snout to beginning of dorsal	0	9
Length from tip of snout to tip of gill-cover	0	9
Length from tip of snout to nape	0	7½
Greatest depth of body	1	1
Highest dorsal spine	0	3
Length of attachment of dorsal	1	11
Length of attachment of anal	0	7
Length of pectoral ray (longest)	0	9½
Length of alimentary canal from gullet to anus	2	8
Length of descending part of stomach	0	5
Diameter of descending part of stomach	0	1½
Diameter of intestine	0	1

The colours of the fish are known only from the specimen preserved in spirits. Above the lateral line it resembled the back of a mackerel; the sides of the body and head were silvery, with a little shading in the wrinkles of the skin, giving it a somewhat scaly appearance; there were no markings discernible on the fins.

THYRSITES ATUN, *var.* ALTIVELIS, *High-finned Thyrsites.*

Thyrsites altivelis, Rich. Zool. Proceed. June 25, 1839, p. 99.

Th. radiis pinnæ dorsi spinosis, corpus altitudine ferè æquantibus; dentibus intermaxillæ utriusque quatuordecim, in latere maxillæ inferioris utroque duodecim.

Radii.—Br. 7—7; P. 14; V. 1|5; D. 20|—1|11 et VII.; A. 1|10 et VII.; C. 17$\frac{6}{5}$.

At the close of an elaborate account of *Thyrsites atun* in the 'Histoire des Poissons,' it is mentioned, that the *Scomber dentatus* of Forster, described in Schneider's edition of Bloch, presents all the characters of *atun*, except that the author states the number of rays in the first dorsal to vary from twenty to twenty-three, while in five examples of

[1] The air-bladder was lost after it was detached from the body, and before it was minutely examined; but it seemed to have no processes at its upper extremity.

the true *atun* of the Cape of Good Hope, the number was uniformly twenty. G. Forster's figure in the Banksian Library (2. No. 222.) is entitled '*Scomber dentex*' and '*Scomber lanceolatus*[1],' and a copy of it being transmitted to Cuvier under the latter name, appeared to him to have a strong resemblance to *atun*. The specimen was obtained in Queen Charlotte's Sound, where it received the appellation of 'Maga' from the natives. Solander's 'Pisces Australiæ' contains an account of a *Thyrsites* taken in Murderer's Bay of the same island, which is most probably identical with Forster's. The following extract of his description contains the most essential parts of it:—"*Scomber splendens. Piscis* 1½ *pedalis, totus nitens, splendens, suprà ex argenteo-nigro cærulescens, subtùs totus argenteus. Iris argentea, nebulis fuscis. Pupilla nigra. Dorsi suprema pars plumbea. Pinnæ primæ dorsalis membrana inter singulos radios obliquè dimidiato-nigricans, alias pellucida. Pinna secunda et pinna ani pellucidæ. Pinnæ pectorales plumbeæ. Pinnæ ventrales albidæ. Pinnulæ spuriæ utrinque sex pellucidæ. Pinna caudalis furcata, pallidè plumbea. Membrana pinnæ dorsalis prioris tenerrima et radii fragilissimi.*—Br. 7; P. 14; V. 1|5; D. 20|—1|11 and VI.; A. 1|11 and VI.; C. 18.—*Linea lateralis, a capite pone medium dorsi valdè approximata dein descendens.*" (Op. citat. p. 29.)

Messrs. Quoy and Gaimard have also described and figured a New Zealand *Thyrsites*, taken in Basmann's Bay. They state the length of the fish to vary from two to three feet, the dorsal to be black, and they represent it as lower than that of *atun*. They give the numbers of the rays as follows:—D. 19 — 11 — VI.; A. 11 — VI.; C. 24; P. 12; V. 1|5. The colours are steel-blue above, becoming almost black on the head, and changing to silvery on the sides and belly. The authors of the 'Histoire des Poissons' not having seen any of these New Zealand fish, hesitate to say whether they differ specifically from one another or from that which inhabits the seas of the Cape of Good Hope.

Mr. Lempriere's second cask of specimens contained a *Thyrsites*, which he stated in his letter to be known at Port Arthur as the 'Baracoota,' and that a second species is taken in that harbour which has lower dorsal spines, and is more esteemed as an article of diet. From the existence of some slight discrepancies between that specimen and the description of *atun* in the 'Histoire des Poissons,' I was led to characterize it as distinct in the paper read before the Society on the 25th of June, 1839; but the receipt of a second example since that time induces me to believe that the species varies in some minor particulars, though the general aspect continues the same, and that it is safer to consider the Van Diemen's Land fish as a variety of the Cape *atun*.

The proportion of the depth of the body, length of the head, and other dimensions, to the total length, agree with those ascribed to the *atun*, except that the diameter of the eye is more nearly a fifth part of the length of the head than a sixth, and that the thickness of the body is less than two-thirds of the depth, the fish being therefore more compressed: the width at the flat nape is however greater, and even exceeds two-thirds

[1] The *Scomber lanceolatus* of Solander is the *Cybium Solandri* of Cuvier.

of the height at that place. The teeth are fewer in number than in *atun*[1], there not being above fourteen on each intermaxillary, or twelve on each limb of the lower jaw. They are all conical, acute, and much compressed, the lateral ones on the lower jaw being the largest of the series. The four more interior, long and strong ones, at the symphysis of the intermaxillaries (two on each bone), are curved backwards, and are very acute. There are some minute teeth on the knob of the vomer, which are more perceptible to the touch than to the sight; and there are twelve or fourteen small ones on each palatine bone, inclining inwards. The bony operculum is divided into two unequal portions by a deep notch, the upper one having a squarish or truncated tip, and the lower one, which constitutes more than two-thirds of the bone, a triangular form. The notch is closed by integument, and its inferior point is underlaid by the tip of the suboperculum, the entire gill-cover having in the recent fish a rounded outline.

The length of the pectoral is more nearly the tenth of the total length than the twelfth, as in *atun*, and the ventrals have nearer half the length of the pectorals than the third. The dorsal spines are slender and very brittle, and the third, which is the longest, is fully equal in height to the depth of the body, while in *atun* the spines are said to be only half the height of the body. The length of the second dorsal is just equal to the height of its first soft ray, and its margin is slightly crescentic. The space occupied by the separate pinnules is nearly one-sixth of the whole length of the fish, being greater than in *atun*. It would appear, however, that even in the Cape examples there is a difference in this respect. In the text of the 'Histoire des Poissons' the number of pinnules above and below is said to be six; in the formula for the rays they are put down as seven, and the figure represents seven above and six below. This figure also exhibits the fish as being covered on the body and head with regular and strongly marked scales, while the text says "*toute la peau de ce poisson paraît lisse*," which is the case with the Port Arthur specimen. The lateral line of *altivelis* curves down at the 16th (instead of the 14th) dorsal spine, reaches its greatest depression between the nineteenth and twentieth, undulates till it arrives opposite to the second dorsal pinnule, and from thence runs straight to the base of the caudal, where it terminates without traversing the portion of smooth silvery integument, from whence the rays emerge. The lateral line is formed by a series of small, oblong, tubular scales, firmly imbedded in the epidermis. There appear to be no other scales on the fish, though the epidermis wrinkles in a reticulated manner. When a piece of the skin is placed under the microscope it shows

[1] "*L'intermaxillaire n'est nullement extensible. Vingt-cinq dents ou environ, coniques, comprimées, de force médiocre, y sont implantées de chaque côté le long de son bord externe : les premièrs sont assez petites, et ne vont pas jusqu'au bout antérieur ; mais sur un rang plus interne, sous la pointe du museau, il y en a de chaque côté deux ou trois, très grandes, comprimées, crochues et très-pointues, qui donnent le caractère le plus apparent de ce sous genre. La mâchoire inférieure a de chaque côté seize ou dixhuit dents comprimées, tranchantes aiguës, plus grand que celles du bord de la mâchoire supérieure ; le vomer, &c.*" The figure does not represent more than twenty teeth on the intermaxillary.

small oval points of unequal sizes, but it is not easy to say whether they are minute scales or merely mucus hardened by the spirit.

The membrane of the first dorsal is of a deep black colour, with a tapering white stripe behind each spinous ray. The other colours have faded, but the thin and easily detached epidermis still possesses a bright silvery nacre. The top of the head and the folds about the jaws and corners of the mouth look blackish.

Anatomy.—The lining of the mouth is deep black; the smooth and flat tongue and the isthmus are very narrow, and between the second and third arches the isthmus rises into an acute smooth ridge[1]. Each of the extremely slender branchial arches is studded with two rows of small tubercles, covered with minute bristles, mixed with three or four longer but slender and very acute rigid spines, of unequal length; tubercles still more minute run forward on the sides of the isthmus to the root of the tongue. The pharyngeal bones are long and narrow, particularly the under ones, which are broadest behind and acute forwards: the upper ones are three on each side; all are covered with moderately strong, densely villiform teeth, which curve inwards. The stomach is a long, nearly cylindrical tube, which gives off its very short pyloric branch near the gullet. The cæca, seven in number, are pretty long, but unequally so. The long air-bladder becomes narrower as it approaches the gullet, and there ends, in a short, slender, obtuse process. There appeared to be no other contraction or appendix, though it was not extracted so entire as to render its shape quite certain. A multitude of parasitical worms lay coiled circularly in the peritoneum. The stomach contained some very small fish and minute crustacea.

Dimensions.

	Inches.	Lines.
Length from intermaxillary symphysis to tips of caudal lobes	16	2
Length from intermaxillary symphysis to end of central caudal rays	15	0
Length from intermaxillary symphysis to end of lateral line	14	0
Length from intermaxillary symphysis to anal	10	2
Length from intermaxillary symphysis to beginning of soft dorsal	10	0
Length from intermaxillary symphysis to anus	9	9
Length from intermaxillary symphysis to ventrals	4	0
Length from intermaxillary symphysis to pectorals	3	8
Length from intermaxillary symphysis to end of gill-flap	3	6
Length from intermaxillary symphysis to beginning of spinous dorsal	3	3
Length from intermaxillary symphysis to centre of eye	1	9
Diameter of eye	0	8
Length of pectorals	1	$6\frac{1}{2}$
Length of ventrals	0	$8\frac{1}{2}$

[1] "*La langue n'est garnie que d'une plaque un peu âpre.*"—Hist. des Poissons. In our (two) specimens the surface of the tongue is quite smooth, though there are some tubercles at its base on each side.

	Inches.	Lines.
Height of third dorsal spine	1	8
Height of sixth ditto[1]	1	2
Height of first and seventh	1	$1\frac{1}{2}$
Height of nineteenth	0	5
Height of soft dorsal and anal	1	0
Length of caudal lobes	2	$3\frac{1}{2}$
Depth of caudal fork	1	2
Depth of body at pectorals	1	9
Thickness of ditto	0	11
Length of œsophagus and stomach	5	6
Length of longest pyloric cæcum	2	0

A second specimen, preserved in brine, has been more recently received, which resembles the preceding one strongly, but it has only six spurious pinnules above and below on the tail, and the lateral line curves under the fourteenth spine. The dorsal spines are injured, but they appear to have been a little lower than those of the specimen described above. I am not inclined to consider it as specifically distinct.

Dajaus Diemensis, *Tasmanian Dajaus.*—*Dajaus Diemensis*, Rich., Zool. Proc. March 10, 1840; Jenyns, Zool. Beagle.

D. rostro ferè truncato vix prominente.

Radii.—Br. 6 – 6; P. 15; D. 4 — 10; A. 3|12; V. 1|5; C. $14\frac{5}{4}$.

The Mullets resemble one another so closely, that at first sight it appears difficult to detect distinctive characters; there are, however, differences in the proportions of the head and other parts, in the form of the lips, suborbitars, eye, tongue and palate, and in the various distribution of rough plates on the interior of the mouth, which, by their combinations, furnish characters for the discrimination of species. There is also some variety of internal structure, such as in the lining of the intestinal canal, the form of the stomach, and the number of pyloric cæca in different species. The Van Diemen's Land Mullet here described presents a group of characters not to be found in any of those which are enumerated in the 'Histoire des Poissons,' and it may be readily known from them all, at first sight, by its smaller scales and more numerous rays in the anal fin. It is furnished with plates of fine teeth on the palate and vomer, on which account I have placed it in the subgenus *Dajaus*. It is true that these teeth are small, and the plates, before the mucus is cleared away from them, appear scarcely to differ from the rough patches in the interior of the mouth of some acknowledged Mullets, one of which, *Mugil saliens*, has even the vomer rough. But when the roof of the mouth is well washed, the vomerine and palatine teeth of *Dajaus Diemensis* are distinctly visible to the naked eye, being similar to, and nearly as long as, those on the jaws; and

[1] The tips of the fourth and fifth spines are mutilated in the specimen.

the mouth has a form intermediate between *Dajaus monticola* and the typical Mullets, without any other vestige of the mesial keel on the lower jaw, tongue and isthmus, than the thin fold of integument which separates the lower pharyngeal plates. If, therefore, *Dajaus* is to be retained as a separate group, this Van Diemen's Land fish seems to belong properly to it. *Dajaus monticola*, the only previously described species, inhabits the fresh waters of the Caribbee Islands, near to their sources, but we are not informed whether it visits the sea or not. *Dajaus Diemensis* is taken in the sea that washes the shores of Tasman's peninsula in Van Diemen's Land. Mr. Lempriere has furnished me with no other information respecting it, than that it is highly esteemed as an article of food, and that the specimen described below is of the usual size. The 'Histoire des Poissons' mentions three Mullets from New Holland and one from New Zealand. Two of them, *Mugil Peronii* and *M. acutus*, have keeled tongues, only two pyloric cæca, and the ascending branch of the stomach cylindrical. The latter has also a more acute snout than is usual in Mullets. *Mugil Ferrandi*, from Port Jackson, has a keel in the middle of the otherwise flat tongue, and a black stripe in the axilla of the pectoral, with another tipping the caudal fin. None of these correspond with our *Dajaus* in the number of their rays. The *Mugil Forsteri* of New Zealand is figured with an acute snout; and the little that is known of it does not agree with the Tasmanian fish, which Mr. Darwin has shown to range as far as King George's Sound, on the west coast of Australia.

Form.—Elongated, compressed; the curvature of the back moderate, and somewhat less than that of the belly. The greatest height of the body is one-fifth of the whole length, caudal included. At the nape the height is one-fourth less than under the spinous dorsal, and the height of the tail behind the anal is less than half that of the body. The breadth is greatest at the shoulder, and from thence it diminishes imperceptibly to the caudal fin, that of the back being throughout greater than that of the belly, though the latter is flattened for a small space before the ventrals.

The head is flatly rounded above, like the back, and it diminishes in thickness to the end of the snout, which is half the width of the nape, and is very obtuse, almost truncated. There is a considerable notch between the nasal bones, which in the recent fish is filled by integument stretched evenly across. The lips have very little development on the intermaxillaries or lower jaw; but the sides of the mouth, when distended, are largely closed by membrane, within which the labial plays, not reaching the margin of the orifice. The intermaxillaries have considerable protractility, and the lips which cover them being widest towards the symphysis, they press back the soft integument of the snout in a very slightly lunated manner when the mouth is closed. The lower jaw then shuts in beneath the intermaxillaries, the commissure being a segment of a circle. When the mouth is fully extended, its orifice, viewed in front, represents a semi-elliptical arch, the lower jaw being a transverse chord. The intermaxillary widens exteriorly into a thin plate, which is deeply notched posteriorly, and recedes a little from the soft margin of the mouth. A similar ascending process of the lower jaw nearly touches the plate; and the tip of the straight cylindrical maxillary, which never reaches the margin of the mouth, is connected to both by thick short folds of integument, allowing free motion, but preventing the three bones from separating to any distance from each other. The maxillary glides entirely beneath the infra-orbitar. The limbs of the lower jaw are of even width, lie parallel to each other and their own breadth apart, the space between being occupied by a fillet of smooth integument, which shows also interiorly, before the tongue, where there is a mesial furrow instead of a keel, as in some other Mullets. The limbs of the jaw are each pierced by four pores, and are scaly; they separate into a different plane from the intervening cushion when they are depressed. The dental surface of the jaw is thin, the integuments forming a distinct lip or fold at the angle only of the mouth, considerably behind which the thin vertical plate of the jaw lies in the membranous parietes, producing by its action on the tip of the labial the protrusion of the intermaxillaries.

A fine stripe of minute villiform teeth borders both jaws, and immediately behind them, above and below, there is a narrow velum. The slender transverse ridge on the fore-part of the vomer is covered with rather shorter teeth, and on each palate bone there is a tapering stripe, which runs backwards at a right angle with the vomerine one. Some distance behind these there is a square villiform patch on the mesial line, and a lateral one on each side, broader than the anterior ones. The roof of the mouth is arched, and is destitute of any indentation in the fore-part of the vomer, or of a mesial furrow farther back. The tongue has a flat surface, without a vestige of a central keel; but it is bordered by a row of rough plates, and it has two very minute stripes on its tip. Neither is there any keel shown by the soft parts within the jaw, anterior to the tongue; and there are no papillæ on the parietes of the mouth.

The eye comes near to the profile of the forehead, but does not touch it, and its diameter is equal to one-fifth of the length of the head: it is twice as far from the gill-opening as from the end of the snout. The eyelids have no remarkable extension. The two orifices of the nostrils are approximated, and are placed before the eye. The sub-orbitar is shaped much like that of *Mugil capito*; it has no notch anteriorly, and is toothed on its rounded tip and on the lower part of its anterior margin. It is not ridged, neither is its surface perfectly even.

The scales are rectangular, with three straight sides, the exposed edge alone forming the segment of a circle: this edge is finely but irregularly toothed, and the adjoining surface is also roughened by minute teeth: on the base there are from eight to ten well-marked, slightly diverging furrows, which scarcely produce marginal crenatures. There are fifty scales in a longitudinal line, exclusive of some small ones on the base of the caudal. The head is scaly above, down to the nostrils, and also beneath, with the exception of the suborbitar, the isthmus connecting the limbs of the lower jaw and the very narrow gill-membrane. Between the ventrals there is an acutely conical scaly plate, with a loose tip, but there is no vestige of similar plates exterior to these fins, though, as the specimens have lost a few scales in their long voyage, there is some uncertainty on this point. [*Mugil curvidens* wants these appendages, and they are more or less restricted in other species.] There are traces of scaly stripes between the rays of all the fins but the first dorsal. [*M. cryptocheilos*, *curéma*, *petrosus*, *Dussumieri*, *melanopterus* and *carinatus* are described in the 'Histoire des Poissons' as having scaly dorsals and anals.]

The gill-membrane is so narrow that the branchial ribs could not be counted without dissection. The pectoral is obliquely pointed, its upper rays being longer, and the lower ones very short. The second dorsal is supported by ten rays, of which the first, which lies closely against the second, is the only simple one: it looks like a spinous ray, but with a good eye-glass the articulations of its tip become visible. The first anal spine is scarcely perceptible; the third is half the length of the soft ray which succeeds it; all the three spines are pungent: the margin of the fin is concave. The scaly fillet lying between the pectorals covers a membranous fold which binds both fins down to the abdomen. The caudal is forked.

Colour.—The scales have a golden lustre; but the specimens retain no traces of lines or shades of colour, nor any remains of spots on the pectorals or other fins.

Anatomy.—The large air-bladder is as long as the abdomen, but its exact form was not ascertained. Like the peritoneum, it is covered by a blackish pigment. The alimentary canal descends from the pharynx in a tube nearly of equal width, till it forms a projection of the stomach similar in size and form to the pyloric cæca. To the side of this 'cul de sac' there is attached the globular, gizzard-like part of the stomach, which is coarsely plaited interiorly, the folds becoming much finer as they extend upwards into the œsophagus. The pylorus is surrounded by a narrow but distinct villous valve that projects into the gut, but there are no long filaments springing from it as in *Mugil cephalus.* The succeeding part of the gut is somewhat dilated, and its interior is finely reticulated with villous rugæ. The three cæca[1] open into this wider part of the canal immediately below the pylorus: the canal narrows below, the rugæ soon disappear, and the membranes of the gut become more delicate. The rectum is a little wider; but I could detect no papillæ in it, nor in the small gut, nor any cilia on the thickened ring which marks the junction of the two. The rectum alone shows faint and very delicate reticulations on its inner coat. On each side of the upper surface of the pharynx there is a soft, spongy, oval cushion, which is studded with soft warts intermixed with minute teeth; before this there are two small lobes that represent the foremost pair of pharyngeal bones. At the root of the tongue there is a very minute cluster of teeth, but the narrow isthmus of the branchial arches, anterior to the lower pharyngeal bones, is flat and smooth. These bones oppose long, narrow, nearly flat, dental surfaces

[1] *Mugil cephalus*, *Dajaus monticola*, and many other Mullets have two cæca; others have six, seven, eight, ten, or seventeen; but none are described in the 'Histoire des Poissons' as having *three*.

to the upper pharyngeal cushions, and their small longitudinal, mesial keel of smooth integument fits into the division between the latter. The first branchial arch bears an exterior row of compressed, subulate, and acute rakers. The inner row of that arch, and both rows of the other arches, consist of short, compressed, triangular processes, which are toothed interiorly.

The stomach of the individual that was examined was lined with coagulated mucus, which exhibited no remains of any organized body when examined under the microscope.

Dimensions.

	In.	Lin.
Length from intermaxillary symphysis to tips of caudal fin	10	2
Length from intermaxillary symphysis to ends of central caudal ray	9	6
Length from intermaxillary symphysis to base of caudal (in centre)	8	9
Length from intermaxillary symphysis to end of dorsal	7	2
Length from intermaxillary symphysis to end of anal	7	1
Length from intermaxillary symphysis to beginning of second dorsal	6	3
Length from intermaxillary symphysis to beginning of anal	5	$8\frac{1}{2}$
Length from intermaxillary symphysis to anus	5	$6\frac{1}{2}$
Length from intermaxillary symphysis to beginning of first dorsal	4	$3\frac{1}{2}$
Length from intermaxillary symphysis to ventrals	3	3
Length from intermaxillary symphysis to pectoral	2	4
Length from intermaxillary symphysis to edge of gill-cover	2	2
Length from intermaxillary symphysis to centre of orbit	0	9
Distance between the orbits	0	8
Long axis of orbit	0	5
Vertical axis of orbit	0	$4\frac{1}{2}$
Height of body (greatest) under first dorsal	2	0
Height of tail	0	10
Height of nape	1	6
Width at humerus	1	2
Width at first dorsal	0	10
Distance between first and second dorsals	1	3
Distance between second dorsal or anal and tail	1	3
Width of snout	0	7
Height of first dorsal	1	0
Height of second dorsal or anal	1	0
Length of pectorals	1	8
Length of ventrals	1	1
Length of second dorsal	0	$10\frac{3}{4}$
Length of anal	1	$2\frac{3}{4}$

		In.	Lin.
Length of caudal (central rays)		1	2
Length of caudal lobes		2	2
Length from diaphragm to cæcal tip of stomach		2	3
Length of cæcal tip beyond the ascending branch		0	7
Length of longitudinal diameter of nearly globular gizzard		0	$8\frac{1}{2}$
Length of pyloric cæca from	9 lines to	0	11
Length from pylorus to rectum		10	0
Length of rectum		2	0
Length of whole alimentary canal from pharynx, about		15	0

Clinus despicillatus, *Bull-head.*

Clinus despicillatus, Rich., Zoolog. Journ. June 1839, p. 90.

Tab. VI. Fig. 2.

Cl. brunneus, maculis hepaticis sex in summo dorsi instructis infraque fasciatim per latus descendentibus; maculisque tribus ad basin pinnæ caudæ; tentaculis narium geminatis, minutis; tentaculis superciliaribus brevissimis palmatis; squamæ minutæ.

This fish, known at Port Arthur by the name of 'Bull-head,' is considered to be unfit for food: it hides under stones. The figure, which is drawn of the natural size, represents it so accurately that a lengthened description is unnecessary; indeed, it bears so close a resemblance to *Clinus perspicillatus*, and corresponds so nearly to the description of that fish in the 'Histoire des Poissons,' that it may prove, on an actual comparison of specimens, to be only a variety. It appears, however, to have a thicker body, a larger head and a smaller eye, and wants the nuchal marks which give the appellation of 'spectacled' to that species, though the configurations of colour on the body do not otherwise differ materially.

There are six roundish blotches on the dorsal, each placed partly on the back, partly on the fin, and formed of a congeries of irregular spots: an equal number of vertical spotted bands descend the sides, and there are some smaller intermediate dottings.

The sides of the head, and the edges of the dorsal and anal fins, are also thickly spotted with umber-brown; and there are three rows of spots on the pectoral, as many on the caudal, with three large spots at the base of the latter. The scales are small and depressed as in *perspicillatus*; there is a bifid cirrhus at the nostrils, and a very short palmated one with fine branchlets on the upper margin of the orbit.

Rays.—Br. 6 – 6; P. 14; V. 2; D. 36|4; A. 2|25 or 26; C. 14.

The inner ventral ray has a very short branchlet at its base. The three first dorsal rays are a little apart from the succeeding ones, though connected by a slightly notched membrane. The fin is nearly of equal height throughout, rising a little where it is supported by the soft rays, but rounded off by the shortening of the two last. The membrane of the dorsal fin is largely attached to the caudal, but the anal is quite distinct: all the rays of the caudal are simple, the extreme one on each side being shorter.

Dimensions.—The figure is of the natural size, and carefully measured in all its proportions.

BLENNIUS TASMANIANUS, *Lempriere's Blenny.*

Bl. tasmanianus, Rich., Zool. Proceed. June 23, 1839.

Bl. capite magno, sphæroideo, tentaculo superciliari vix diametrum orbitæ æquante, apice bifido; pinnâ dorsi medio emarginatâ, anticè arcuatâ; aculeo primo octavum æquante, intermediis gradatim longioribus; dentibus caninis.

This Blenny, the first that has been brought from Van Diemen's Land, is nearly connected by external form with *Blennius gatturigine* and *fucorum*, differing from them principally in the proportions of parts.

It has a compressed, elongated shape, diminishing both in height and thickness from the head backwards, and more suddenly behind the vent. The height of the body at the pectorals is equal to one quarter of the total length, and the thickness at the same place is less than two-thirds of the height. The head has a compressed, sphæroidal form as in *gatturigine*, but it is larger and rather more gibbous on the forehead, particularly at the orbit, which projects a little in the profile. Laterally, the head is most prominent at the cheeks and preoperculum, its diameter there being equal to its length, or to two-thirds of its height, and greater than the thickness of the body. The preoperculum forms an arc of a circle in its outline, and the breadth of the operculum, including its membranous edging, is equal to two-sevenths of the length of the head. There is a semicircular notch in the bone, which is filled by membrane in the recent fish, nearly as is represented in the figure of *B. palmicornis* in the 'Histoire des Poissons.' The teeth, as in others of the genus, are linear, compressed and obtuse, forming in each jaw a close, semicircular, even row; each series being terminated at both ends by an acute, awl-shaped and slightly curved canine tooth. In the larger of our specimens there are thirty-four teeth in the upper jaw and thirty in the lower, exclusive of the canines; the smaller specimen has six fewer in each series. The superciliary filament is scarcely equal in length to the diameter of the orbit, is thickish at the base, tapers upwards, and ends in two short thread-like tips of unequal lengths.

Rays.—P. 14; D. 12|17 or 18; A. 21; V. 2; C. 14.

The dorsal fin, commencing over the posterior edge of the preoperculum, terminates exactly at the base of the caudal, but has no membranous connexion with that fin. There is a depression or notch at the junction of the spinous with the articulated part of the dorsal, and the former has an arched form, owing partly to the curvature of the back, and partly to the rays lengthening slightly from the first to the fourth. The eighth is about equal to the first, and the following four are successively shorter, contributing to produce the notch. The fourth articulated ray is also the longest, exceeding the corresponding spinous one one-third; but the decrease of the posterior ones is very gradual, and the last, which shortens more perceptibly, is only one-third lower. The last rays are bound down in an oblique direction to the back by the membrane which reaches nearly to their tips, giving a rounded form to the end of the fin. The spinous and articulated portions occupy equal spaces, or about one-third of the total length of the fish, as in *gatturigine*. The anal is supported by twenty-one rays, the first being very short: their tips pass beyond the membrane, and their length is about one-third less than that of the rays of the opposite dorsal. The fin terminates a short way from the base of the caudal, and is highest at the commencement of its posterior third, but not so much so as to produce a decidedly arched outline. The pectoral has an oval outline, the rays becoming successively stouter from the upper one and lengthening to the tenth, after which they again shorten. The ventrals, attached far forwards, contain two simple rays. The caudal contains eight rays forked at the tips (two of them being even trifid), and three simple incumbent rays above and below. There is no membranous edging to the caudal exterior to the rays. The length of the fin is equal to one-sixth of the total length of the fish, as in *gatturigine*.

The lateral line curves downwards opposite to the tip of the pectoral, and then runs straight along the middle of the tail.

Dimensions.

	Female. In.	Female. Lin.	Male. In.	Male. Lin.
Length from intermaxillary symphysis to end of caudal	3	11	4	6
Length from intermaxillary symphysis to beginning of caudal	3	3	3	10
Length from intermaxillary symphysis to end of dorsal	3	2	3	8
Length from intermaxillary symphysis to end of anal	3	1	3	7½
Length from intermaxillary symphysis to beginning of anal	1	8	2	2
Length from intermaxillary symphysis to pectorals	0	11	1	0
Length from intermaxillary symphysis to end of gill-cover	0	9	1	2
Length from intermaxillary symphysis to beginning of dorsal	0	8½	0	10½
Height of body at pectorals	0	9½	1	1
Height of body behind anus	0	7¼	0	8¾
Thickness of body at pectorals	0	5¼	0	7¼
Diameter of eye	0	2¼	0	2½
Height of fourth dorsal spine	0	3½	0	4
Height of fourth articulated ray of dorsal	0	5¼	0	6
Height of fourteenth anal ray	0	3½	0	4
Length of anal	0	7½	0	8
Length of pectoral	0	8	0	8¾
Length of ventrals	0	7	0	7¼
Length of space between anal and caudal	0	1½	0	2

PLATE IV.

Fig. 1. SERRANUS RASOR, near the natural size.

1 *a*. Vertical section.
1 *b*. Scale from the lateral line, magnified.

Fig. 2. NEMADACTYLUS CONCINNUS, natural size.

2 *a*. Vertical section at the fifth dorsal spine.
2 *b*. Scale from above the lateral line, magnified.
2 *c*. Ditto from the lateral line, magnified.

PLATE V.

Fig. 1. TRIGLA VANESSA, half the natural size.

1 *a*. Vertical section.
1 *b*. Scale from the side, magnified.
1 *c*. Ditto from the lateral line, magnified.
1 *d*. Dorsal scale, natural size.

Fig. 2. TRIGLA POLYOMMATA, natural size.

2 *a*. Vertical section.

PLATE VI.

Fig. 1. LATRIS HECATEIA, half the natural size.

1 *a*. Vertical section.
1 *b*. Side view of the jaws, natural size.
1 *c*. Scale, magnified.
1 *d*. Ditto from the lateral line, magnified.

Fig. 2. CLINUS DESPICILLATUS, natural size.

2 *a*. Vertical section.

Fig. 1. [illegible] p. 73. Fig. 2. Nemadactylus concinnus. p. 75.

Fig 1 d

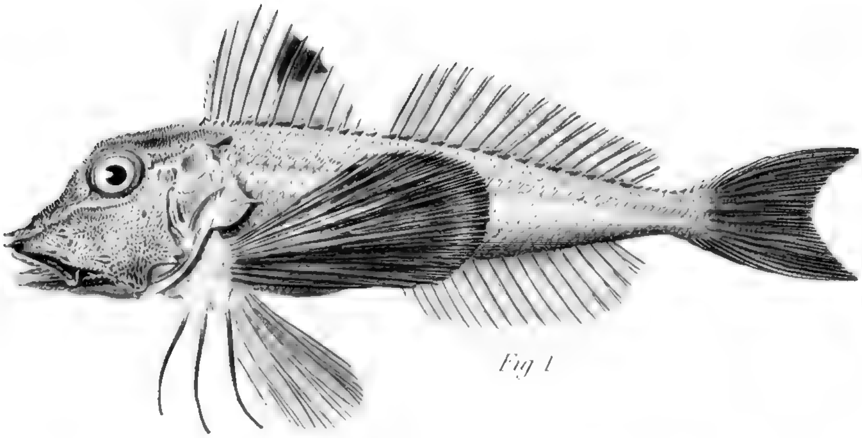


Fig 1

Fig 1 a

Fig 1 b

Fig 1 c

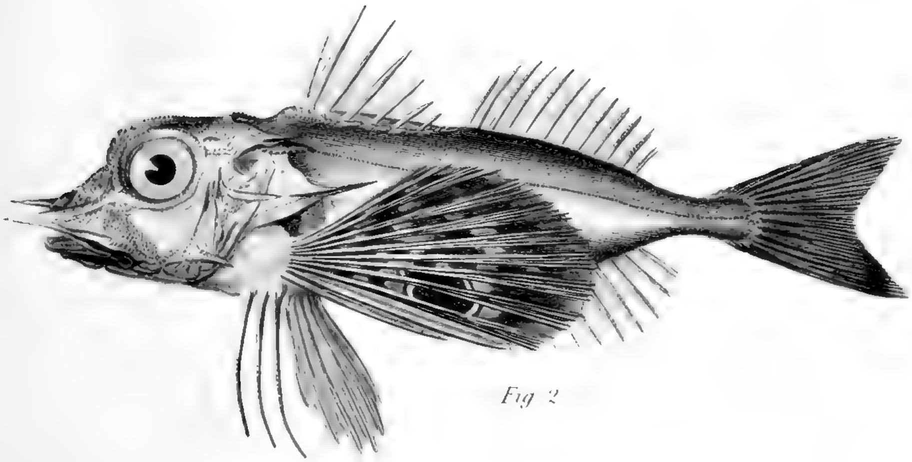


Fig 2 a

Fig 2

J. M. Curtis del.

J. Basire sc.

Fig 1 Trigla vanessa ... _ Fig 2 Trigla polyommata ...

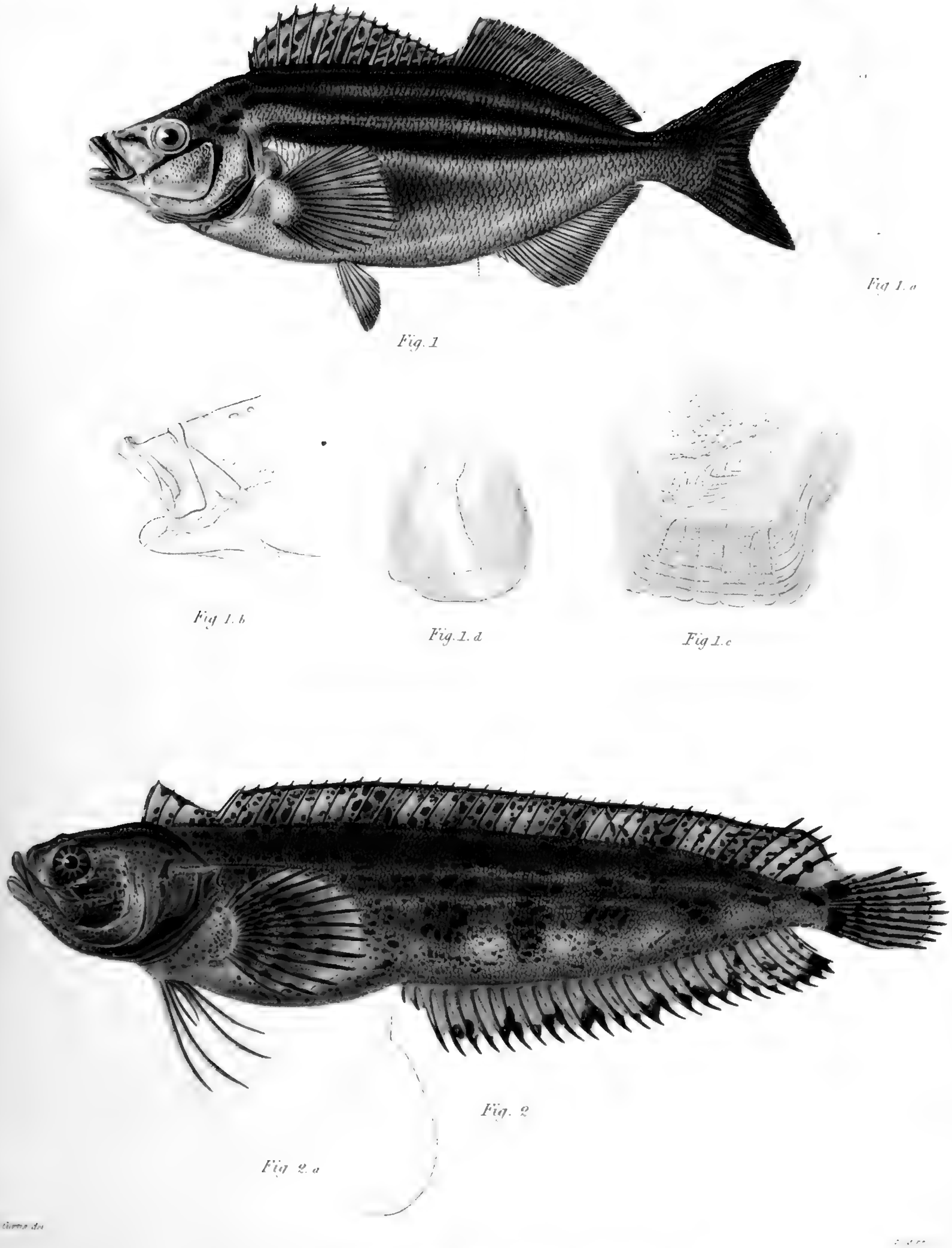


Fig. 1. *Latris hecateia* p. 106. — Fig. 2. *Clinus despicillatus* p. [illegible]

V. (Part 2.) *Description of* Australian Fish. *By* JOHN RICHARDSON, *M.D., F.R.S., &c., Inspector of Naval Hospitals, Haslar.*

Communicated June 25, 1839, March 10, 1840, and March 9, 1841.

CHEIRONECTES POLITUS (Nob.), *Polished Cheironectes.*

Ch. dorso bipinnato, corpore lævi, glabro, rubicundo, punctulato.

Mr. Lempriere's list contains the following observation on the only specimen of this fish in the collection. "Its colour is red, with spots, and all that I have seen were of the same size. Nothing is known of its qualities as an article of food, as none of the residents at Port Arthur have eaten it. An imperfect representation of it appeared in Dr. Ross's 'Van Diemen's Land Annual' for 1835." This figure is certainly rude enough, though it may be recognized by those who have seen the fish. It gives much more development to the membrane of the first dorsal than is shown by our specimen, but the edges of the fins in the latter have suffered a little by friction against other fish contained in the same cask during the voyage from Port Arthur.

The *Cheironectes politus* belongs to that subdivision of the genus which is characterized by the second and third nuchal rays, being connected to each other and to the back by a continuous membrane so as to form a first dorsal. Two species only of this group are mentioned in the 'Histoire des Poissons'. Of one of these, *Ch. hirsutus*, it is said, "*la scabrosité de la peau n'est pas très-forte*;" and of the second, though it bears the name of '*lævis*,' "*sa scabrosité, quoique formée de même, est un peu moins rude au toucher.*" *Politus* is perfectly smooth to the touch and to the sight assisted by a common eye-glass ; and there are no membranous appendages visible on any part of the body.

The height of the body, at the ventrals, is equal to one-third of the total length, and behind the pectorals to one-fourth. The thickness at the same places is equal to about half the height. The under jaw, when depressed, projects beyond the upper one, and the forehead rises from the latter almost perpendicularly, soon however rounding off towards the nape in the segment of a circle. The small eye is situated not far from the front, above and a little behind the angle of the mouth. The pectoral fin is supported by a rather long arm-like base, and the very small round branchial aperture is rather above and a little posterior to the axilla. The first ray of the anterior dorsal is free, or connected to the second by a very minute fold of skin: it is comparatively short, and originates at a short distance from the upper lip. The second ray is the longest, and is connected to the slightly shorter third one by a thickish membrane, which is prolonged backwards in a triangular slip that reaches nearly to the second dorsal; or as the skin of the back is somewhat loose and forms a small fold, it may be considered as actually connected to the base of the second dorsal. The two anterior rays of the first dorsal are before the eye, and the third is just over it The second dorsal commences over the axilla of the pectoral by a very short incumbent ray, and is continued to the base of the caudal. Anteriorly it is equal in height to the first dorsal, and the posterior rays diminish in succession, but not much. The anal is equal in height to the part of the dorsal opposite to it, and terminates near the base of the caudal by a minute ray. The membrane of both fins is in the specimen a little frayed on the edge, and a single very fine thread-like point projects from each ray. In the caudal two points equally fine project from each of the seven intermediate caudal rays, the upper one above and below, showing only a single point.

Radii.—P. 9; V. 1|4; D. 1, 3|—15; A. 8; C. 9.

The fish after long maceration in spirits appears of a shining reddish brown, with minute pale marblings or reticulations, seeming to the naked eye like cracks in the cuticle. Two irregular pale blotches occupy some space near the base of the second dorsal, and there is a darker tint between the pectoral and eye. In Dr. Ross's figure a semilunar dark line is represented over the eye, a smaller but broader one above the base of the pectoral, and three fainter ones along the base of the dorsal.

Dimensions.

	In.	Lin.
Length from intermaxillary symphysis to base of caudal	2	$3\frac{1}{2}$
Length from intermaxillary symphysis to beginning of caudal	1	8
Length from intermaxillary to vent	1	0
Height at ventrals	0	8
Height behind pectorals	0	6
Thickness at pectorals	0	4
Length of pectorals	0	6
Length of second ray of first dorsal	0	6
Length of third ray of first dorsal	0	5
Length of second and third ray of second dorsal	0	6
Height of anal	0	5

Labri, *Wrasses.*

The collection contains four different Wrasses, but it is to be regretted that the labels having fallen from all the specimens, Mr. Lempriere's notes of the colours of the recent fish cannot be confidently assigned to the proper species. The name of 'Parrot Fish' is locally applied to the gayer *Labri*, the striped *Balistes*, and to some *Ostracions.* Two of the Wrasses appear to have been comparatively little ornamented (*L. tetricus* and *fucicola*), and the other two to have been tinged with lively colours, or even brilliantly striped (*psittaculus* and *laticlavius*), but they are all true *Labri*, and bear a general resemblance in form to the *Labrus bergylta* of the 'Histoire des Poissons.' The scales which clothe their opercula are in fact much larger than in that species, but being imbedded in a mucous skin, they are scarcely discernible until that is partially removed. In a recent state, therefore, these fish might be easily mistaken for examples of the genus *Tautoga*, which they also resemble in possessing a pretty regular inner row of minute teeth. The opercular scales overlie the junction of the suboperculum, as in many European species, leaving however the greater part of the latter bone naked. There are no scales whatever on the interoperculum, in which respect these Port Arthur Wrasses differ from *Labrus bergylta, mixtus, trimaculatus, turdus*, and some others. The scales upon the cheek are small, and as they vary in the four Wrasses as to their distribution, we are thus furnished with a ready means of distinguishing the species from each other. In all the four the teeth are longer and stronger at the symphyses of the jaws than in *bergylta* or *mixtus*, and the posterior ones being small, their diminution is more rapid, as in the genus *Julis*. All have a canine tooth implanted in the posterior extremity of each intermaxillary, and directed forwards. It varies in size in different species, and even in different individuals of the same species, but is seldom larger than the teeth next the symphysis. Occasionally there is a small canine tooth at the root of the larger one. In both jaws there exists an interior row of small teeth, more complete than in *bergylta* or *mixtus*. The suborbitar lips are not greatly developed, and do not conceal the swelling plaited ones which are attached to the upper jaw, but the maxillaries lie much under the suborbitars, their lower ends appearing only when the mouth is open. The lower lip folds back in a rounded plait on each limb of the jaw. The intermaxillaries of *tetricus* and *fucicola* admit of very little protrusion, and even in *laticlavius* and *psittaculus*, where they have longer pedicles, they are not so protractile as in *mixtus*. In the 'Histoire des Poissons' the Wrasses are said to have in general more spinous rays than jointed ones in the dorsal fin, and the anal spines are described as generally short and thick. In the Tasmanian species, which we are commenting upon, the spines of the anal are rather slender, though they are not so long as the soft rays, and the dorsal spines are not only less numerous than the jointed ones, but they are also rather slender, and have membranous tips. The outline of the caudal fin varies in the different species, and narrow scaly fillets of various lengths are interposed between the bases of the rays. None of the other fins have any scales on their membranes. In the number of the rays the Tasmanian Wrasses agree very nearly with each other and with the *Labrus pœcilopleura* of New Zealand.

L. tetricus, Br. 6—6; P. 13; D. 9|11; V. 1|5; A. 3|10; C. 14.
L. fucicola, Br. 6—6; P. 13; D. 9|11; V. 1|5; A. 3|10; C. 14.
L. laticlavius, Br. 5—5; P. 12; D. 9|11; V. 1|5; A. 3|10; C. 14.
L. psittaculus, Br. 5—5; P. 13; D. 9|11; V. 1|5; A. 3|10; C. 13.

Labrus tetricus (Nob.), *Grim Wrasse.—Labrus tetricus*, Richardson, Zool. Proceed., June 25, 1839, and March 10, 1840.

L. squamis minutis in ordinibus duobus, ad marginem anteriorem superiorem preoperculi instructis; operculo squamis majoribus in seriebus ternis quaternisve dispositis tecto.

Radii.—Br. 6—6; P. 13; D. 9|11; V. 1|5; A. 3|10; C. 14.

This Tasmanian Wrasse and the following one are noted by Mr. Lempriere as being coarse food, disagreeable to some palates, but not unwholesome. Judging from the contents of their intestines, they feed much on crustacea.

Form.—Labrus tetricus has a short and rather bluff head, which measures one-fourth of the total length, caudal included: the height of the tail is nearly one-half of that of the body at the pectorals; and the greatest height of the body is about equal to one-third and eight-tenths of a third of the whole length. The scaleless parts of the head are clothed with thick skin studded with small pores, which appear a little elevated as the surface dries, and at the same time the suborbitar, cranium, margin of the orbit, and preoperculum become very rough and irregular. Three or four rows of large thin scales, about half the size of those of the body, and not regularly disposed, cover the operculum and part of the suboperculum; and two rows of very small scales run close before the anterior margin of the upper limb of the preoperculum from its top till the curve at the angle is complete, leaving a large naked cheek. There are eleven teeth in the outer row in each intermaxillary and limb of the lower jaw, exclusive of one pretty large straight canine tooth, with a small one behind it on the posterior extremity of each intermaxillary. The teeth run in straight lines on each side of each jaw, so that when the mouth is open and viewed in front, they form a rectilinear rhomboidal figure. The interior row of teeth is small, and not very visible except in the dried specimen. The pharyngeal teeth have the usual generic form. The intermaxillary lips are plaited into seven or eight shallow folds, the inner fold being studded by minute wart-like papillæ.

The scales covering the body are large and thin, their membranous edges splitting and curling as they dry. There are twenty-six rows between the gill-opening and the caudal, besides three rows more crowded lying over the bases of the caudal rays. The lateral line runs straight from the supra-scapular till it comes opposite to the end of the dorsal, when it makes a bend downwards for the full breadth of one scale, after which it continues its course through the centre of the tail. On each scale it is marked by a slender undulating tube, which suddenly branches by three or four successive bifurcations in an arbuscular manner. The ventral fins are pointed, the first and second soft rays being the longest. The dorsal spines increase a little in length from the first to the ninth, which does not however exceed the former by above one-third. The soft rays are a little longer than the last spinous one, but are nearly equal among themselves, as are also the anal ones. The caudal is even at the end, or when fully spread out very slightly convex. The spines of the vertical fins generally are rigid, but rather slender.

When the fish was taken from the spirits the soft dorsal and anal appeared very dark, the other fins yellowish or orange. The body also looked dark, but on detaching a scale from the back the membranous sheath inclosing it was found to be of a lively purplish red. All traces of coloured zones or spots, if any ever existed, had disappeared. The skin and membranes generally were very tough, and the membrane of the fins thick and opake.

The intestinal canal is a wide tube, the stomach being of a larger diameter than the rest, and having its internal coat densely villous. The villous plaits are reticulated, and become more and more delicate until they disappear altogether, leaving the fourth part of the tube next the anus smooth. The first caudal vertebra has its inferior process of a narrowly linear lanceolate form, with a broad, thin, rounded shoulder or plate on each side of its junction with the body of the vertebra. Two holes for the passage of vessels exist in the process, the succeeding caudal vertebræ having only one.

DIMENSIONS.

	In.	Lin.
Length from intermaxillary symphysis to extremity of caudal fin	18	0
Length from intermaxillary symphysis to end of larger scales on ditto	16	2
Length from intermaxillary to end of dorsal	12	11
Length from intermaxillary to first soft ray of ditto	8	6
Length from intermaxillary to beginning of dorsal fin	4	7
Length from intermaxillary to nape	3	3
Length from intermaxillary to edge of gill-cover	4	3
Diameter of orbit	0	8
Length of pectoral	2	8
Length of first spine of dorsal	0	11
Length of ninth ditto	1	4
Length of rays of caudal	2	9
Length of naked part of fin (beyond small tongues of scales)	1	10
Height at ventrals	4	9
Height of tail	2	1

LABRUS FUCICOLA (Nob.), *Purple Wrasse.—Labrus fucicola*, Richardson, Zool. Proceed., June 25, 1839, and March 10, 1840.

L. squamis inter oculum et preoperculum in seriebus quatuor instructis, parvis; squamis opercularibus majusculis.

Radii.—Br. 6—6; P. 13; D. 9|11; V. 1|5; A. 3|10; C. 14.

This species, though it has a general resemblance to the preceding, differs from it as follows. The bones of the head though uneven are much less so than in *tetricus*, and the scales of the operculum are more irregular in size, a few small round ones being scattered among the larger ones. The cheek is protected by four rows of small roundish scales, which do not approach so near the ridge of the preoperculum as in the preceding species, but on the contrary the uppermost row, which consists of fewer and longer scales, differing from the others in their oblong form, runs close to the margin of the orbit. The scales extend as far forward on the cheek as the anterior part of the eye, and run up behind, in three rows only, nearly to the supra-scapular. The teeth are stronger than those of *tetricus*, the eight or nine anterior ones on each side not diminishing so rapidly as they recede from the symphysis, and being followed by five or six considerably smaller ones. This arrangement is alike in our two specimens. The canine tooth at the angle of the mouth is slightly curved, the inner row of small teeth is more complete, particularly posteriorly, than in *tetricus*, and the main rows on each side are disposed in convex, not straight lines. The scales on the body are a little smaller than in *tetricus*; the lateral line which makes the same kind of curvature under the end of the dorsal contains twenty-seven scales, and there are four additional rows on the base of the caudal, exclusive of the small tongues of scales between the rays. The caudal is considerably rounded in its outline, the anal is also somewhat arched, and the fore-part of the soft dorsal is higher than the posterior part. The dorsal spines are of similar proportions with those of *tetricus*.

The specimens have lost their colours, and the only remaining indications of their original markings are some faint lines curving beneath the eye over the cheek to the nose and a bar crossing the pectoral at a third of its length. A drawing, made at Port Arthur by a convict under Dr. Lhotsky's inspection, of a Wrasse which resembles this species more closely than any of the others in the collection, represents the general colour of the upper parts as dark plum-purple, the belly fading to buff, with four pale spots on the back, one of them on the supra-scapular, another close to the eighth spinous ray of the dorsal, and two others touching the base of the soft dorsal, the distances between them being nearly equal. The *Labrus fucicola* possesses nine abdominal and sixteen caudal vertebræ. The first of the latter differs from the corresponding one of the preceding species in its inferior process having an acute shoulder instead of a rounded one, in its limb being merely narrowly linear, not lanceolate, and in its lower opening being larger than the one next the body of the vertebra.

DIMENSIONS.

	1st Spec.		2nd Spec.	
	In.	Lin.	In.	Lin.
Length from intermaxillary symphysis to end of caudal . . .	15	0	11	4
Length from intermaxillary symphysis to end of scales on caudal	13	4	10	0
Length from intermaxillary symphysis to end of anal	10	10	8	1
Length from intermaxillary symphysis to end of dorsal	10	6	7	10
Length from intermaxillary symphysis to beginning of anal . .	8	3	6	4
Length from intermaxillary symphysis to anus	7	11	6	2
Length from intermaxillary symphysis to ventrals	5	0	3	$7\frac{1}{3}$
Length from intermaxillary symphysis to dorsal	4	0	3	4
Length from intermaxillary symphysis to pectorals	4	0	3	4

	1st Spec. In.	1st Spec. Lin.	2nd Spec. In.	2nd Spec. Lin.
Length from intermaxillary symphysis to edge of gill-cover	4	0	3	2
Length of soft dorsal	3	6	2	5
Length of spinous dorsal	3	6	2	5
Length of anal fin	3	0	2	2
Length of pectorals	2	5	1	11
Length of ventrals	2	0	1	2
Length of caudal rays	0	0	2	0
Length of scaleless part of caudal	1	9	1	4
Length of naked space between dorsal and caudal	1	4	1	3
Length of naked space between anal and caudal	1	8	1	$7\frac{1}{4}$
Height of soft part of dorsal	1	6	1	$3\frac{1}{2}$
Height of soft part of anal	1	$4\frac{1}{2}$	1	2
Greatest depth of body	4	8	3	$8\frac{1}{2}$
Greatest thickness of body	2	3	1	6
Greatest thickness of head at preoperculum	2	9	0	0
Height of tail	2	3	1	6
Diameter of orbit	0	7	0	$5\frac{2}{3}$

LABRUS LATICLAVIUS (Nob.), *Patrician Wrasse.—Labrus laticlavius*, Richardson, Zool. Proceed., June 25, 1833, and March 10, 1840.

L. smaragdinus, fasciis binis lateralibus puniceis purpureo marginatis, posticè in unam coalescentibus inque pinnâ caudæ productis; pinnâ dorsi basi viridâ; in mediâ latè purpureâ: supernè aurantiacâ, purpureo guttatâ, inque margine extremo cæruleâ; pinnâ ani basi aurantiacâ, dein primulaceo-flavâ utrinque cæruleo cinctâ, exinde purpureâ cæruleo guttatâ, denique in margine extremo cæruleâ.

Radii.—Br. 5—5; P. 12; V. 1|5; D. 9|11; A 3|10; C. 14.

This very handsome Wrasse seldom exceeds a foot in length. It has a more slender and elegant form than either of the preceding Tasmanian Wrasses. The head is neat and small, forming less than one-fourth of the total length, caudal included. The membranous edge of the gill-cover is produced into a rounded lobe, which extends nearly its own breadth further backwards than the superior attachment of the operculum. In *Labrus tetricus* and *fucicola*, the operculum is joined to the shoulder by a membranous production, which is even with the posterior edge of the gill-cover, rendering the gill-opening a vertical slit, not a curved one, as in the present species.

The scales which cover the operculum are few, thin, large, and not uniform. A considerable portion of the suboperculum is naked, and there are no scales on the other bones of the gill-cover. A vertical row of about six scales descends midway between the orbit and upper limb of the preoperculum, but does not reach so low as the curve of the latter. The rest of the cheek is quite naked. The branchiostegous membrane is much restricted. The integuments of the head are less spongy and porous than in the two preceding species. There are eleven teeth on each side of each jaw, with a tolerably strong canine tooth at the angles of the mouth. The inner row of teeth is about as numerous as the outer one. The pectoral and caudal fins are much rounded. The spinous part of the dorsal is very even, its rays being all equal in length, except the first one, which is a little shorter. The soft part is higher and very slightly arched, as is also the anal. The ventrals are much pointed, the tapering point being formed by the first and second soft rays; their membranes, and those of the pectorals, are delicate and transparent. The scales have equally thin membranous edges with the preceding species, but are rather more rounded and less rhomboidal in outline, and they show their streaks more strongly in the dried specimen, giving it at first sight the appearance of having toothed or fringed scales. The lateral line contains twenty-six scales, exclusive of two rows without tubular elevations on the base of the caudal, and the short tongues of small scales between the rays. It curves, as in the preceding species, to the full depth of one scale at the end of the dorsal. The tubular elevations of each scale have a compact arbuscular form, being thrice bifurcated.

A drawing made by a convict under Dr. Lhotsky's inspection at Port Arthur, and undoubtedly relating to this species, presents the following colours. Ground colour of the back, sides, and head, deep duck-green. A lake-red stripe commencing at the supra-scapular, and another beginning above the base of the pectorals, run parallel to the back, and unite opposite to the end of the dorsal into a single broader stripe, which is continued through the middle of the tail and dorsal. A stripe of the same colour runs from the under caudal rays on each side of the anal fin to the belly and breast, where it spreads out more broadly. All these stripes are bounded by Berlin-blue lines, composed of a series of streaks, one on each scale. Many lake-red lines radiate on all sides from the orbit, over a blue ground on the cheek, and green on the rest of the head. There are also some anastomosing and longitudinal red lines on the interopercular and lower jaw. The pectorals and ventrals are carmine red, the dorsal purplish red, with many small round blue spots between the summits of the rays, and then a bordering fillet of vermilion edged with blue. The anal has along the base a narrow stripe of vermilion, then a broad one of primrose yellow, edged above and below with blue, and lastly a band of purple as broad as the yellow one, spotted thickly with blue and edged with the same. The caudal is plum-purple, beautifully spotted at the end with round blue dots.

Our two specimens, though long kept in spirits, still show most of these markings, but they differ from the drawing in the streaks radiating from the eye, viz. two crossing the anterior suborbitar, three descending over the cheek, and two passing to the nape, besides some undulating lines on the interoperculum which are blue, not red; and in there being five rows of short plum-blue lines on each side beneath the pectorals, not shown in the drawing, and three such lines on each side of the anal. The drawing represents a reddish-brown blotch on the side opposite the commencement of the anal, between the second and third red stripes, which is not visible in either of the specimens. The specific name alludes to the ornamental blue studs on the fins resembling the *clavi* on the borders of the Roman patrician dress.

The intestines were nearly destroyed in the specimen which was opened, but the contents of the stomach had evidently been small crustacea mixed with littoral weeds, particularly one like the common Grass-wrack of our own coast (*Zostera maritima*). The vertebræ are nine abdominal and sixteen caudal. The first caudal one differs remarkably from that of the two first-described Wrasses in its transverse or descending process, consisting of two slender arms, which springing directly from the body of the vertebra, meet at their tips and inclose a single wide elliptical arch. This species is prized for the table, and is said by Mr. Lempriere to exhibit all the colours of the rainbow when newly caught.

DIMENSIONS.

	In.	Lin.
Length from intermaxillary symphysis to extremity of caudal	11	3
Length from intermaxillary to end of dorsal	8	2
Length from intermaxillary to end of anal	8	4
Length from intermaxillary to beginning of anal	5	0
Length from intermaxillary to anus	4	9
Length from intermaxillary to beginning of dorsal	2	6½
Length from intermaxillary to edge of gill-flap	2	5½
Length from intermaxillary to anterior margin of orbit	0	9
Diameter of orbit	0	5
Length of pectorals	1	8
Length of ventrals	1	6
Length of space between dorsal and caudal	1	1
Length of space between anal and caudal	1	1
Length of caudal rays	1	9
Length of naked part of fin (beyond tongues of scales)	1	1
Height of body at ventrals	2	9½
Thickness of body at ventrals	1	2
Height of spinous part of dorsal	0	9
Height of soft dorsal where greatest	1	0
Height of soft anal	1	0

LABRUS PSITTACULUS, *the Lory Wrasse.*—*Labrus psittaculus*, Richardson, Zool. Proceed., June 25, 1839, and March 10, 1840.

L. squamis genæ in ordinibus quatuor ad preoperculum approximatis, oculoque remotiusculis; corpore compresso, ovali; pinnâ caudæ supernè apiculatâ.

Radii.—Br. 5–5; P. 13; D. 9|11; V. 1|5; A. 3|10; C. 13.

The specimen to which we have given this specific name, has in spirits an uniform hyacinth-red colour, but without any other indications of peculiar markings than five or six rows of honey-yellow spots on the soft dorsal and anal, and a few streaks on the naked part of the cheek near the angle of the mouth. The pectorals and ventrals are transparent, and show no indications of spots. The dorsal spines increase gradually in length from the first to the ninth, which is a third longer. The first soft ray is higher than the adjoining spine and its membranous tip; the other articulated rays increase successively to the tenth, which is the longest. In the anal, on the contrary, all the articulated rays are nearly of one length, or of the same height with the middle of the soft dorsal. The anal and dorsal terminate opposite each other as in *L. laticlavius*, while in *tetricus* and *fucicola* the anal is more remote from the caudal than the dorsal. The pectoral is cut away posteriorly by a sloping line, so that the second ray is the longest. The caudal is even at the end, with the exception of the greatly branching extremities of the second and third upper rays, which form a short projecting tip. The left ventral in our specimen has only four articulated rays, the other one has five, as usual.

The gill-cover is shaped much as in *L. laticlavius*, but the membranous lobe is smaller. The scales of the operculum are equally large, yet more numerous and more tiled: rather more of the suboperculum is naked, as is also the whole of the broad interoperculum. The cheek is much more scaly, there being four rows beneath the eye, three higher up and two behind the eye. They approach close to the ridge of the preoperculum, and extend as far forward as the centre of the eye, leaving a naked space of the breadth of two scales between them and the margin of the orbit.

The form of this fish is a pretty regular oval, and the body is more compressed than is usual in a *Labrus*. The length of the head is equal to fully one-fourth of the total length including caudal, and the greatest depth of the body is a little more. The jaws are narrower and longer, and the intermaxillaries more protractile than in any of the preceding species. There are twelve or thirteen teeth on each side of each jaw in the outer row, besides the curved canine tooth at the angle of the mouth, all small except the pair at the symphysis and the canine tooth. The inner row is conspicuous enough anteriorly in both jaws, but does not extend backwards beyond the sixth tooth of the outer row. The scales, thin and flexible, have rather narrower membranous borders, and a more rhomboidal form than in the preceding species. The lateral line containing twenty-six scales, curves at the nineteenth, opposite the end of the dorsal, to be continued straight through the centre of the tail. There is one large scale beyond on the base of the caudal on which the tubular ramifications do not exist, making twenty-seven in all, and small scaly tongues between the rays. The tubular divisions are less numerous than in *L. laticlavius*, the ultimate branchlets seldom exceeding eight or nine in number in the anterior scales, or half that number on the tail, nor are they perforated by numerous pores as in the species just named.

The spine, as in the other species, is composed of nine cervical and sixteen caudal vertebræ. The first caudal one differs from that of *laticlavius* in the limbs of the elliptical arch, formed by its transverse processes, being broader, and uniting at the base to form an additional smaller opening close to the body of the vertebra. The descending process of the succeeding vertebra is also broad and is perforated by two holes. There are differences in the pharyngeal teeth of all the species, but they are too minute to be described without entering more into detail than is desirable.

Dimensions.

	In.	Lin.
Length from intermaxillary symphysis to end of upper caudal lobe	10	3
Length from intermaxillary symphysis to end of scales on caudal	9	0
Length from intermaxillary symphysis to end of dorsal fin	7	6½
Length from intermaxillary symphysis to end of anal fin	7	6
Length from intermaxillary symphysis to beginning of anal	5	2
Length from intermaxillary symphysis to anus	5	0
Length from intermaxillary symphysis to ventrals	3	2
Length from intermaxillary symphysis to beginning of dorsal	2	6½
Length from intermaxillary symphysis to pectorals	2	6
Length from intermaxillary symphysis to edge of gill-flap	2	6
Diameter of eye	0	5
Length of space before the eye	0	9
Length of pectorals	1	11
Length of ventrals	1	2
Length of spinous part of dorsal	2	4
Length of soft do.	2	8
Length of anal	2	4
Length of naked part of tail	1	5
Height of first dorsal spine	0	5
Height of ninth or last	0	9½
Height of ninth soft ray of dorsal	1	2
Height of ninth soft anal ray	1	0
Height of body at ventral	2	10
Height of tail	1	3
Greatest thickness of body	1	2

The greater part of the description of *Labrus pœcilopleura* in the 'Histoire des Poissons,' applies also to *psittaculus*, but the latter species has a shorter head, and higher body; its pectorals, which cannot be said to be large, have a ray more; the upper angle of the caudal projects further than the rest of that fin, and there are no traces of a stripe on the suborbitars, or of spots on the flanks in the specimens after maceration in spirits.

Hoplegnathus.

The Museum of Haslar Hospital contains a specimen of a Scaroid fish which was obtained by the late D. B. Conway, Esq., Surgeon of the Royal Navy, in a voyage to Australia. As Mr. Conway was Medical Superintendent of a convict ship, which is not allowed to touch at any port in the voyage out, and the fish belongs to a littoral tribe, it is probable that the specimen was procured either at Sydney or Hobart Town, but there is nothing except this presumption to guide us to its real habitat. This fish, with jaws similar in construction to those of the true *Scari*, has a continuous lateral line like *Odax*, but it differs from both these genera in the smallness of its scales, and from the *Labroideæ* in general in its scaly vertical fins. I have therefore invented for it the new generic name of *Hoplegnathus*[1] (from ὁπλὴ *ungula*, and γνάθος, *dentes, maxilla*), in allusion to the horse-hoof form of the jaws, with which the teeth are incorporated. The specimen being merely a mounted one, I am unable to complete the generic character by describing the form of the pharyngeal teeth, and giving other details of the internal structure, but the external aspect is so much that of a scienoid fish, and so unlike to any of the *Labroideæ*, and particularly to the subdivision of the family with which it is most naturally connected by its dentition, that there seems to be a propriety in giving it a proper generic name, if for no other purpose than that of directing the attention of ichthyologists to this curious annectent form.

In dentition and construction of the jaws *Hoplegnathus* approaches more nearly to the typical *Scari* than to *Odax*, but the upper lip covers two-thirds of the intermaxillaries, and moves with these bones, provision being made for this motion by a deep, smooth, transverse furrow which separates the lip from the integuments of the nose. The bony operculum has two rounded lobes with a deep semicircular notch between them, and its surface, as well as that of the large cheek, is protected by small scales. The scales of the body are also small, not very regularly disposed, and encroach on the base of the soft parts of the vertical fins, fillets of much more minute scales running up between the rays to two-thirds of their height. On the caudal these scaly stripes run nearly to the ends of the rays. The spinous rays are strong, round and sharp, very unlike the flexible spines of *Odax*, and stronger than in any *Scarus* which I have seen. The anal contains three spines. The lateral line is composed of a series of simple tubular elevations, disposed in a regular curve parallel to that of the back, until it reaches the end of the dorsal, when it takes a straight course through the tail. In the specimen it is continued for some way over the caudal. In *Odax* the lateral line changes its direction much further forwards, while in *Scarus* it is interrupted.

Hoplegnathus, genus novum.

Corpus ellipticum, crassum, squamis parvis oblongis tectum. *Linea lateralis* continua. *Mandibulæ* modo Scarorum dentes incorporatos gerentes. *Labium* superius basi

[1] This word was misspelt *Oplegnathus* in the Proceedings.

profundè sulcatum, intermaxillas ferè tegens, et cum illis movens. *Operculum* osseum altè sinuatum, hinc bilobatum, cum genâ squamis parvis tectum. Dorsum monopterygium. *Costæ branchiostegæ* quinque. *Pinnæ ventrales* ponè pectorales sitæ, radiis quinque ramosis et uno aculeato sustentatæ. *Radii spinosi* pinnarum dorsi anique fortes. Fasciæ squamosæ inter radios articulatos pinnarum verticalium decurrentes.

Hoplegnathus Conwayii species unica cognata.—*Oplegnathus Conwayii*, Richardson, Zool. Proceed., March 10, 1840.

Tab. VII. Fig. 1.

Radii.—Br. 5 — 5 ; P. 18 ; V. 1|5 ; D. 12|12 ; A. 3|12 ; C. $15\frac{4}{4}$.

Form.—Profile oval from the jaws to behind the dorsal and anal, where it is joined by a short tail. The vertical axis of the oval is contained twice, and one-half in the longitudinal one, from which the tail is excluded, the greatest depth being under the middle of the dorsal. The upper and under profiles of the head are both equally convex, being parts of the regular curves, but there is a slight gibbosity above the nostrils, and the jaws project somewhat from the ellipsis. The thickness of the body appears to have been about two-thirds of the height, but the specimen being stuffed, its exact shape cannot be ascertained.

The head forms a quarter of the whole length, caudal included. The orbit, placed near the upper profile, is exactly its own diameter behind the furrow at the base of the intermaxillaries, and about twice as far from the tip of the gill-cover. The space between the eyes is somewhat less than two diameters of the orbit. The nostrils are situated near the upper anterior angle of the eye, the two openings near each other. The posterior one is the largest; the anterior one has a slightly tubular margin. The intermaxillaries and lower jaw have a convex horse-shoe form, with on the anterior part four or five rows of small, smooth, oval teeth ranged in quincuncial order, shining through the smooth surface as in *Scarus*. The cutting edge of the jaws is irregularly granular from the projections of the teeth in use, but there are none more prominent than the others, either at the symphysis of the intermaxillaries or posteriorly. On the interior of the intermaxillaries, at some distance behind the cutting edge, there is an irregular bony protuberance, with five or six small rounded teeth just showing their points. There are no remains of a velum either in the upper or lower jaw, but behind the protuberance that has just been mentioned, there is a small rounded knob on each intermaxillary covered with integument, the concave passage between them leading to the unarmed palate. The lower jaw shows no vestige of a symphysis on the dental surface. The lips do not appear to have been plaited, but cover more than two-thirds of the jaws, and move with them. A deep transverse furrow divides the upper lip from the nose. The labial, nearly of a triangular form (its broad and rather rounded lower end forming the base of the triangle), lies in the lower part of the furrow which forks to surround it. There seems, as far as we can judge from a dried specimen, to have been no development of a suborbitar lip, and little of the labial is covered by that bone. The broad and deep, finely scaly cheek comes forward to the labials, and is bounded both below and behind by the smooth preoperculum. The upper limb of this bone is very narrow and inclines backwards. The lower limb is broader and runs forward to beneath the labial at the distance of two diameters of the orbit beneath the eye, and curves gradually behind into the rounded angle of the bone. The disk of the bone is neven, but not rough. The anterior edge of the first suborbitar is even, the posterior ones are very narrow. They are all scaleless, as is the whole top of the head, as well as the labials, lips, gill-membranes, and interoperculum. The bony operculum is twice as high as wide, and is terminated posteriorly by two rounded lobes, with a deep semicircular notch between them. In the recent fish the notch is filled up by thick membrane, which also narrowly edges the lobes. The surface of the operculum is clothed with small scales that terminate irregularly a little way from its posterior margin; a few small scattered scales exist on the suboperculum, which is narrow, and does not project beyond the operculum.

The humeral chain of bones is covered with naked skin, except that there is an oval scaly patch between the limbs of the supra-scapular, and an irregular cluster of scales on the reverted plate of the coracoid immediately above the pectoral fin. The edge of this process of the coracoid is obliquely and irregularly crenated, the crenatures corresponding to fine furrows on the surface. In the axilla of the fin there is a broad, scaleless, triangular plate. The axillæ of the ventrals are also scaleless, and there does not appear to have been any scaly process between these fins. The scales covering the body are small and oblong, truncated or cut concavely at the base, and narrower than the uncovered edge, which is flatly curved. There are from five to ten or eleven very short and almost obsolete, slightly diverging furrows on the base. The lines of structure parallel to the lateral edges of the scale are rather strong, and the uncovered portion, protected by a thick mucous epidermis, appears to be dotted, and even toothed on the margin in the dried fish, but this roughness disappears on maceration. Each scale is imbedded in a strong sac of the very tough skin. The scales are smaller towards the anterior part of the back than on the sides, and become again very sensibly smaller below the level of the pectorals. They are smallest before the ventrals, but behind these fins, on the centre of the belly, there is a stripe on which the scales are as large as on the sides, and more of their surface is exposed. The scales end on the nape by a transverse line even with the upper end of the preoperculum.

The lateral line has a curve corresponding to that of the back from the supra-scapular till it passes the dorsal fin, it then passes horizontally through the tail to the caudal fin, on which it is prolonged to within one-third of its margin, this portion of it being slightly deflected. It is composed of a series of tubular elevations, of which there are fifty in the arched part of the line, and about twenty from thence to the base of the caudal. None of the tubes are branched.

Radii.—Br. 5 — 5; P. 18; V. 1|5; D. 12|12; A. 3|12; C. $15\frac{4}{4}$.

The fin membranes appear to have been thick, and the soft parts of the dorsal and anal are scaly and fleshy at the base. Broad fillets of very fine and closely tiled scales run up between the rays for about two-thirds of their length. The caudal is scaly almost to the edge. The ventrals are situated under the middle of the pectorals, and beneath the commencement of the dorsal. The spinous ray is moderately strong, and two-thirds of the length of the soft ones. The fin has a rounded outline. The first dorsal spine is short, the fifth and sixth are the longest, but they are only half as high as the soft rays. The twelfth spinous ray, resting closely against the soft part of the fin, is a little longer than the preceding one. All the spines are strong, round, and acute. The anal spines are short, particularly the first one, but they are sufficiently strong and sharp. The soft parts of both anal and dorsal are highest anteriorly, and terminate posteriorly in rays twice as short without any rounding off. The caudal is slightly crescentic on the margin, but its lobes are not very acute.

Dimensions.

	In.	Lin.
Length from intermaxillary symphysis to end of central caudal rays	19	2
Length from intermaxillary to base of caudal	17	2
Length from intermaxillary to end of ventral	13	3
Length from intermaxillary to gill-cover tip	4	9
Length of caudal lobes	3	4
Length of central caudal rays	2	0
Length of naked tail	2	4
Length of intermaxillaries from basal furrow	1	2
Length from basal furrow to orbit	0	11
Diameter of orbit	0	11
Distance between orbit and gill-opening	1	8
Thickness of body	4	0
Height under middle of dorsal	6	0
Breadth between the eyes	1	7
Depth of caudal fork	0	4
Length of pectorals	2	6
Length of ventrals	2	0
Height of second dorsal spine	0	6
Height of fifth and sixth spines, which are largest	1	5
Height of eleventh spine	0	8
Height of third and twelfth	0	$9\frac{1}{2}$
Height of soft rays of dorsal and anal anterior	2	6
Height of posterior do.	0	11

Since the preceding account of *Hoplegnathus* was read before the Society, I have had an opportunity of seeing a specimen of a second species in Mr. Dunn's Chinese Museum, and figures of two others in the beautiful collection of drawings made at Canton by John Reeves, Esq. These three Chinese fish differ so little from each other, that they may prove on further examination to be mere varieties. They have larger vertical fins than *H. Conwayii* with an additional soft ray or two, are shorter and higher in the body, and are more or less thickly covered with round black spots. Our specimen of *Conwayii* retains no distinct traces of markings, but on removing the varnish from one side, the scales of the belly showed a bright silvery lustre, with a reddish-brown tinge on the epidermis, and some dark blotches appeared on the back and sides, but no defined spots smaller than the eye, as in the Chinese species.

ODAX ALGENSIS (Nob.), *Kelp Fish.*—*Odax algensis*, Richardson, Zool. Proceed., March 10, 1841.

O. capite longiusculo ; preoperculo denticulato ; facie utrinque sex striato.

Radii.—Br. 5 — 5 ; D. 17|12 ; A. 2|12 ; P. 14 ; V. 1|4 ; C. $12\frac{3}{3}$.

This fish is known at Port Arthur by the appellation of 'Kelp fish,' I suppose from its frequenting thickets of the larger fuci. The specimen described below is said to be of the usual size of the species. In the stomach I found two small crabs, nearly divested of their shell but not much bruised, and many minute white bivalve shells of which one or two only were entire, the rest being comminuted. A few fibrils of a red fucus (*Florideæ*, Lam.), covered with the gelatinous ova of a marine animal, were lying between the pharyngeal bones. The species differs from any of those described in the 'Histoire des Poissons,' in the regular and strong teeth on the edge of the ascending limb of the preoperculum, but agrees with the typical species (*semifasciatus*) very closely in the great majority of its details.

Form.—Elongated, compressed, the profile of the head a lengthened, rather obtuse cone, the lower jaw ascending rather more than the forehead descends. The head is lower and longer than that of *semifasciatus*, its length being contained three times and a half in that of the whole fish caudal included. The body has nearly the same relative height with *semifasciatus*, but its thickness is somewhat less, being inferior to that of the head at the nape. It tapers beyond the anus gradually into the stump of the tail, where the height does not equal the half of that at the pectorals. The eye almost touches the profile of the forehead, and is situated rather nearer to the intermaxillary symphysis than to the tip of the gill-flap. The diameter of the orbit is rather less than one quarter the length of the head, and it equals the space between the posterior angles of the orbit, the head consequently is either considerably more compressed than in *semifasciatus*, or the eye of the latter is proportionally smaller.

Gape of the mouth small, horizontal, scarcely reaching half-way to the orbit. Lips tumid, plaited, covering the dental surface. Suborbitar edged with soft skin, forming a short lip, which is lost before it reaches the angle of the mouth as well as superiorly. A row of raised tubes or pores marks the under edge of the narrow suborbitars, and run beneath and behind the eye.

The whole upright limb of the preoperculum down to the slightly rounded elbow, is regularly toothed so as to appear pectinated. These teeth are concealed by membrane in the recent fish. The horizontal limb which meets the other at a right angle is entire. The operculum is cut nearly even with a projecting point terminating its upper margin, this point being a little lengthened out by membrane and cartilage. The suboperculum ends in a strap-shaped flexible cartilaginous tip, which is streaked and fissile in the streaks, forming at its extremity about fourteen fringe-like teeth. In the recent fish this process is slightly visible through the integuments, and runs beyond the bony operculum, forming the tip of the gill-cover. The operculum is thickly covered with four rows of tiled scales, larger than those on the cheek or behind the eye. Suborbitars, jaws, limbs of preoperculum, suboperculum and interoperculum naked. The gill-membranes uniting under the posterior margin of the orbit are overlapped by the somewhat free edges of the interopercula. Scales widely oblong, the sides parallel, the base with a slightly projecting lobe, and about eleven fan-formed streaks. The uncovered part of the scale is thin, the edge membranous and rounded. The lateral line is curved anteriorly as in *semifasciatus*, and after passing the tip of the pectorals runs straight to the caudal, at an equal distance from the back and belly. Each scale is furnished with a simple tubular elevation. The teeth, which are incorporated with the intermaxillaries and lower jaw as in *Scarus*, are lanceolate, slightly swelling, smooth, and in many rows. The cutting margin on each side of each jaw shows from eight to twelve unequally distant little blunt points, the one on each side of the symphysis being larger than the rest. Both jaws are furnished with an even edged velum. The pharyngeal bones, formed as in *semifasciatus*, have a dental surface similarly constructed with that on the anterior surface of the jaws. Branchial rakers short, rounded and bristly.

Radii.—Br. 5 — 5; D. 16|13 or 17|12; A. 2|12 or 3|11; P. 14; V. 1|4; C. $12\frac{3}{3}$.

The first branchial rib is much broader than the others, which are very slender. The dorsal in all our specimens has twenty-nine rays, though there is a slight variation in the proportion of the spinous ones. The last six articulated rays are deeply cleft, the more anterior ones scarcely show divisions at the tips under the lens. The height of the fin increases slightly posteriorly, the two last rays being a little shorter, so as to round off the fin a little. The spinous rays are very fine and flexible. The anal has a similar form. The greatest height of either is equal to that of the body. The pectorals and ventrals correspond with the description of *semifasciatus*, and the latter are connected by a scaly triangular process as in that species. The caudal is rounded—not square as in *semifasciatus*.

The colours of the specimens have completely faded in the spirits. Mr. Lempriere says, that in a recent state they were beautifully striped with red and blue on the sides of the head. There are still traces of three fine (blue?) lines running over the suborbitars from the snout to past the eye, and three shorter (red?) ones from the angle of the mouth to the cheek. There are no configurations of colour on the body. A specimen since received from Port Arthur, preserved in brine, exhibits a dark purple edging on the dorsal and anal fins, which are also marked by many very short, slender oblique bars, regularly crossing the rays. The end of the caudal is dark. The colours of the body are faded.

DIMENSIONS.

	In.	Lin.
Length from intermaxillary symphysis to tip of caudal	5	5
Length from intermaxillary symphysis to end of scales on caudal	4	9½
Length from intermaxillary symphysis to end of dorsal or anal .	3	10
Length from intermaxillary symphysis to beginning of anal . .	2	11
Length from intermaxillary symphysis to beginning of dorsal .	1	7
Length from intermaxillary symphysis to ventrals	1	9
Length from intermaxillary symphysis to pectorals	1	6
Length from intermaxillary symphysis to tip of gill-flap . . .	1	5¾
Diameter of orbit	0	4
Depth of fish between gill-openings and anal	1	0
Thickness of body	0	5
Thickness of head behind orbit	0	6
Length of pectorals	0	7
Length of ventrals	0	7¾
Length of caudal including its scaly base	0	10
Height of dorsal or anal posteriorly	0	6¾
Length of space between anal or dorsal and caudal	0	8
Height of do.	0	5½

An example of another species having a dark stripe which is wanting in *algensis*, was sent by Mr. Lempriere, but it is too much injured to admit of identification. It is probably the *Odax balteatus* of the 'Histoire des Poissons,' a fish discovered by Peron.

A New Zealand *Odax* is described in Solander's MSS. 'Pisces Australiæ,' which differs from the *Odax pullus* of Forster and the 'Histoire des Poissons' in colour. "*Calliodon vittatus.—Totus piscis castaneo-umbratus subtus multo pallidior. Vitta ex incarnato-argentea, utrinque sub basi mandibulæ inferioris incipiens, sub oculis ducta, per basin pinnarum pectoralium, media latera ad basin pinnæ analis extensa. Sæpe maculæ in seriebus longitudinalibus per dorsum et latera dispositæ. Piscis adultus sesquipedalis a junioribus valdè variat et proportione et colore. Adulti crassi sunt, cum capite parvo, gulâ gibbosiusculâ, abdomine latè rotundato. Vitta lateralis e maculis magnis sordidè carneis interrupta, non continuata. Pinnæ dorsi et ani posticè altiores.* Br. 6; D. 34; P. 14; V. 5; C. 14." (Sol. l. c.) The total number of dorsal rays in *balteatus* does not exceed twenty-eight, while in *pullus* they are 23|11, being the same in amount as in *vittatus*. The native place of *balteatus* is not mentioned in the 'Histoire des Poissons'; *pullus* was taken by

Forster in Queen Charlotte's Sound, and by Messrs Quoy and Gaimard at Port Western, in Bass's Straits.

Lepidoleprus australis (Nob.), *Antarctic Imminiset.—Lepidoleprus australis*, Richardson, Zool. Proceed., June 25, 1839.

Tab. VIII. Fig. 1.

L. aculeis squamarum arctè incumbentibus in ordinibus plurimis; radio dorsali antico submutico; ano sub finem pinnæ dorsi prioris posito; pinnâ ani altitudine plus duplici pinnam dorsi posteriorem superante.

Radii.—Br. 6 — 6; P. 16; V. 1|6; D. 2|11 — 89; C. 1; A. 87.

Icon. nost. Tab. VIII. *Explic.*—Fig. 1. Profile and *b.* section, half size. *c.* Scale from the cheek. *d.* Scale from the lateral line, both magnified. Fig. 2. *a.* Scale from the head. *b.* One from the lateral line of a Madeira specimen of *L. cœlorrhynchus*, both magnified. Fig. 3. A scale from the body of a specimen of *L. trachyrhynchus*, in the Zoological Museum.

Of the genus *Lepidoleprus* of Risso, or *Macrourus* of Bloch, only two species have been fully characterized. The Zoological Museum contains two specimens of *cœlorrhynchus*, one from the Mediterranean and one from Madeira, not differing perceptibly from each other. Cuvier states in his 'Règne Animal,' that the same species ranges northwards to the Iceland and Greenland seas, as he has ascertained by an examination of specimens. But as the figures of the *Macrourus rupestris* of Bloch and other authors exhibit the first dorsal ray rough or serrated, and the descriptions state that the spines on the scales are arranged in rows, which is not the case with the specimens in the Zoological Museum, there seems to be still reason for doubting whether the Arctic seas may not nourish two species[1]. The Rev. R. T. Lowe (Zool. Proceed., May 28, 1839) has characterized the Madeira fish as a distinct species from that of Risso, under the appellation of *M. atlanticus*.

The second well-known species, *L. trachyrhynchus* of Risso, and *Oxycephas scabrus* of Rafinesque, is a Mediterranean fish, but Cuvier does not seem to be quite clear as to its specific differences from a Japanese *Lepidoleprus*, figured in the Atlas of Krusenstern's Voyage (pl. 60. f. 8. and 9.). Of the *Lepidoleprus australis* we have received three examples, all from Port Arthur. Two were so much decayed that they were available only for the osteology of the species, but the third was in pretty good order, and from it the drawing by Mr. Curtis was made of half the natural size. Plate VIII. contains also magnified views of the scales of this and of the two Mediterranean species.

[1] This conjecture is proved to be correct by two northern species being characterized in a paper by Carl. J. Sundevall, which has just reached this country. "Macrourus fabricii, *squamis valdè serrato-carinatis; radio dorsali antico submutico; pinnâ dorsali secundâ ante anum incipiente.* Hab. Hammerfest. M. stromii (Rheinh.), *squamis planis, crebrè spinuloso-hirtis, radio dorsali antico valdè serrato; pinnâ dorsi secundâ longius pone anum incipiente. Squamæ rotundæ parum angulatæ, absque carinis, parte liberâ spinulis setaceis æqualibus, retrorsum adpressis, creberrimè hirtæ.*" Kongl. vetenskaps Academ. handl. för år 1840; Stockh. 1842. A species named Lepidoleprus sclerorhynchus (Valenc.), having a strongly serrated dorsal spine, is figured in Webb and Bertholet's account of the Canaries recently published.

In external form *L. australis* closely resembles *cœlorrhynchus,* but in the latter the scales are armed with thirty or forty acute spines which are not arranged in rows. The scales clothing the sides of the head have very short spines, and those on the prominent lines are coarser than the others. The teeth are very fine but not remarkably short, and there is only a single row of them on the lower jaw. The subjoined description of *australis* points out the differences of that species in these respects. As to *trachyrhynchus*, its tapering snout and other peculiarities of external form prevent any danger of its being confounded with the Van Diemen's Land fish.

Mr. Lempriere remarks that only four examples of the Antarctic Imminiset were taken at Tasman's peninsula in five years, that it has not yet received any appellation from the colonists, and that nothing is known of its habits. Its Greenland congener is named 'Imminiset,' whence Shaw framed the English trivial name which we have adopted. It is said to inhabit very deep waters, to make a grunting noise like a Gurnard, to feed upon worms and zoophytes, to swim with great swiftness, and to lash briskly with its tail when caught. The Greenlanders eat it.

Form.—Moderately compressed, the profile increasing in depth from the acute snout to near the anus, and tapering from thence to the acute point of the lengthened slender tail. The greatest depth is rather less than one-sixth of the total length, and the greatest thickness is rather more than one-half the depth. The section of the body is obtusely oval at the anus, and becomes more and more compressed from thence to the end of the tail. The vent is twice as far from the tip of the tail as it is from the end of the snout.

The head is large, and is almost rigidly encased by bone and its rough scaly covering. Its profile when the mouth is shut is nearly triangular, with an acute edge extending from the apex of the snout to the lower margin of the gill-cover. This edge is almost straight, having only a slight undulation beneath the nostrils, and corresponds to the reflected edges of the nasal, suborbitar and preopercular bones. Beneath this edge the snout and cheeks slope in towards the mouth and lower jaw, and the integuments are covered by scales more minutely and equally granulated than those on the other parts of the head. The nearly vertical sides of the head slope suddenly off from before the orbit to the apex of the snout. The very large eye approaches near the profile but does not alter its direction. The orbit is exactly its own diameter behind the tip of the snout, and rather further from the gill-opening. There is an obtuse and but slightly elevated ridge extending beneath the snout from its apex to the middle of the upper lip, and a more prominent one on the upper surface of the snout which ends between the anterior angles of the orbits. Between the orbits the cranium is slightly hollowed, and on each side of the hollow there is an obscure lateral ridge which disappears on the nape. There is also a mesial ridge on the nape, which reaches from behind the orbits half way to the first dorsal. An elliptical supra-scapular patch is bounded by slightly elevated borders, of which the lower one is the lateral ridge above mentioned, but the patch is more readily distinguished by the scales which clothe it having a different aspect from those of the body than by its bounding ridges. The breadth of the head between the eyes equals the vertical diameter of the orbit. The nostrils are situated in a soft membrane immediately before the eye, the posterior opening being the largest, and having a curved, elliptical form, with the lining of its bottom perforated by a series of openings arranged in a crescentic line. The anterior opening has an oval shape, and is about half the size of the other; it shows some membranous folds within. The exterior edges of both openings are thin and not in the least elevated.

The mouth opens beneath the head, considerably behind the apex of the snout. The intermaxillaries forming the crescentic margin of the upper jaw are capable of protrusion in a vertical plane to the extent of the third of an inch: when retracted they slip nearly under the scaly integument. The lower ends of the maxillaries are but just perceptible in the loose integuments at the corner of the mouth, even in the most extended state of the jaws. The lower jaw opens and shuts in a hinge-like manner into the upper one, whether the latter be protruded or retracted. A small tapering barbel hangs from behind its symphysis.

Teeth.—The intermaxillaries and lower jaw are armed with villiform teeth, the dental surface being broadest at the mesial line, and narrowing to a point on the limbs of the bones. The teeth are small, slender, and acute, slightly curved backwards, and so crowded that the rows cannot be counted on either jaw; the dental surface is evidently rather wider on the upper jaw. The tongue, palate, and vomer are toothless. There are three upper pharyngeal bones on each side, two of the pairs armed with larger teeth, and the anterior pair with much smaller ones. The lower pharyngeal teeth form a triangular patch, divisible into two by a mesial line. All these teeth are similar in structure, each consisting of a cylindrical cartilaginous stem, crowned by a short conical point of enamel which wears down to a ring. The teeth on the jaws exhibit the same form under a lens. The largest pharyngeal teeth are not above the third of a line in diameter, and only about a line in length.

Scales.—The branchiostegous membrane, the margins of the eye and nostrils, the lips and part of the lower jaw are the only scaleless parts of the head, and there is even a scaly patch on the posterior part of each limb of the lower jaw. The scales on the body are moderately large and strong, and are all armed by longitudinal or slightly radiating ridges, composed of closely incumbent tiled spines, the last one forming a tooth-like projection on the edge of the scale. The scales on the middle of the body are largest, and are armed by about eighteen ridges; they are smaller near the head and on the tail, where they have only about twelve ridges. The scales on the opercular bones are smaller than those on the body, and do not overlap each other; and on the rest of the head they are still smaller with much fewer ridges, but from the spines being less evenly tiled, they are rougher. Even on the under surface of the head, where the scales are so minute and uniform as to seem like the points of shagreen, each scale contains one or two ridges of spines, which under the lens are seen to be still more divergent and elevated than the others on the head. The lateral line is distinctly marked by a smooth furrow impressed on 114 scales, and runs in a slightly arched manner, nearer to the back than to the belly in the fore part of the body, then makes a slight curve behind the commencement of the anal, gradually inclining towards the centre of the tail, which it attains within about one-third of its extremity. There are about eighteen rows of scales between the first dorsal and anus, of which three or four are above the lateral line.

Radii.—Br. 6—6 ; P. 16 ; D. 2|11—89 ; V. 1|6 ; A. 87 ; C. 1.

Pectoral rather small and pointed, reaching back to the second anal ray ; all its rays jointed. The first ray is undivided and nearly equals the second, which is the longest. There is a narrow naked space round the pectorals between which and the smooth edge of the gill-opening there are four rows of small scales. First dorsal high, commencing rather posterior to the base of the pectorals, consisting of thirteen rays ; the first a short, stout, incumbent spine, scarcely protruding through the skin ; the second, tall, tapering, with a flexible tip, but with no perceptible branching or articulation, nor any serratures on its anterior border or other sides ; it is scarcely shorter than the adjoining branched one, which is the longest, the remaining rays becoming successively shorter, and the last one having not more than one-fourth of the height of the second or third. The height of the first dorsal is double its length, and nearly thrice as long as the interval between the dorsals. The fore-part of this interval is opposite to the anus. The second dorsal is supported by short, tapering, and mostly unbranched rays. This fin is continued to the tip of the tail, and has for two-thirds of its length an uniform height of less than one-fourth of that of the first dorsal ; in the remaining third the rays shorten successively till at their union with the anal they form an acute point. The posterior rays are forked or branched. The anal fin commencing very near the vent, and consequently somewhat anteriorly to the second dorsal, is like it supported by simple rays till near its tip, where they are forked. The three first rays are a little shorter than the succeeding ones, which for the anterior two-thirds of the fin have an uniform length of nearly thrice that of the second dorsal rays. The anal and dorsal meet at the tip of the tail, from whence there projects directly a single branched ray, which we have named above as the solitary ray of a caudal fin, but which may be added either to the dorsal or anal. The second dorsal and anal fins having fine membranes, are capable of being laid so flatly back as to be scarcely perceptible, though there are no distinct furrows for their reception. Ventrals smaller than the pectorals, attached opposite to the first dorsal ray, and reaching backwards to the anus. The first ray is stout at the base, with a simple, tapering, flexible, soft tip passing beyond the membrane and all the other rays.

Anatomical notices.—Lining of the abdomen black. Œsophagus wide, tolerably long, opening by a somewhat contracted cardiac orifice into a globular stomach. A short oval pyloric branch issues from the stomach near the cardia. The coats of the stomach are moderately strong, but not muscular, the pylorus is contracted, the canal of the intestine narrow, its coats delicate, and the rectum, which is about two inches long, is but slightly dilated. The beginning of the intestine is surrounded by about thirty long, slender pyloric cæca, grouped in four bundles. The intestines contained fragments of shells and crustacea, and the stomach was filled by a firm fleshy animal shaped like a leech. The air-bladder was destroyed, if one had actually existed. The vertebræ consist of fourteen abdominal and fifty-three caudal ones. The spinous process of the second vertebra is longer than that of either the first or third: the succeeding processes increase in length and become more slender: the third caudal spinous process equals the second abdominal one, the rest decrease successively in length and incline more and more, so as to become nearly parallel to the body of the vertebra. The transverse processes of the first caudal vertebra unite into a nearly circular or widely oval hoop; the diameter of the hoop rapidly diminishes in the three following vertebræ, and the canal formed by the remainder is acutely triangular and narrow. There is an elevated acute ridge on the orbitar plate of the frontal bone, crossing it obliquely and running backwards to join the posterior intermediate ridge of the cranium. Near the middle of the orbital plate the ridge is perforated by a large foramen. The pedicles of the intermaxillaries are longer by one-third than the dental surface, and they move under a vaulted space covered by the interior or mesial plates of the greatly developed nasal bones. The ascending plate of each nasal bone, applied to its fellow, forms an elevated ridge whose anterior corner is the extremity of the snout; while the expanding lateral plate or wing has a scabrous or cancellated anterior tip which supports the snout laterally. The first suborbitar is very large, and, like the four succeeding ones which are successively smaller, has its edge reverted to form a broad cancellated surface which sustains the cheek. There is also a triangular cancellated surface elevated in the middle of the preoperculum, and the under margin of it and of the suborbitar plates corresponds to the acute line or ridge which has been described as running backwards from the apex of the snout and forming the under boundary of the flat side of the head.

Dimensions.

	In.	Lin.
Length from point of snout to tip of tail	17	0
Length from point of snout to anus	5	3
Length from point of snout to end of first dorsal	5	0
Length from point of snout to commencement of dorsal	4	2
Length from point of snout to tip of upper lobe or gill-cover	3	5
Length from point of snout to posterior edge of orbit	2	2
Length from point of snout to anterior edge of orbit	1	1
Length from point of snout to intermaxillary symphysis (jaw retracted)	1	0
Length of long diameter of orbit	1	1
Length of vertical diameter of orbit	0	9½

	In.	Lin.
Length of pectorals	2	0
Length of first ray of ventrals	1	7
Length of first dorsal	1	0
Height of first dorsal	2	4
Length of naked space between dorsals	0	9½
Height of second dorsal	0	5½
Height of anal	1	3

SOLEA LITURATA (Nob.), *Dotted Sole.*

S. corpore lituris exiguis geminatis, sparsè sed regulariter variegato; pinnâ ventrali dextrâ cum anali conjunctâ; pinnâ caudæ solutâ.

This Sole belongs to that group of species which has the caudal distinct from the other vertica fins, while the ventral of the right or coloured side is united to the anal. The specimen described below formed part of Mr. Lempriere's collection, but his list contains no information of its habits.

Form.—Profile including the dorsal and anal fins, but excluding the tail, a regular oval; the head and body when denuded of the vertical fins have an ovate outline. The strap-shaped tail and its fin form exactly one-fourth of the total length, which is twice the greatest breadth of the fish.

The mouth is turned to the left side, and is almost concealed on the right side by the tapering tip of the upper rim of the body, which laps over the point of the chin. On the left side the orifice of the mouth curves downwards, both jaws being armed on that side only with very short, erect, villiform teeth. Eyes oval, less than the short diameter of the orbit apart, twice their own length from the gill-opening, and a length and a half from the anterior margin of the head. The nostrils on the coloured side are situated immediately before the eyes, and on the left side over the anterior third of the dental plate of the jaws. The edge of the gill-cover is the arc of a circle whose centre is close behind the lower eye. There are no prominent ridges or lines on the head, the edge of the preoperculum only being very slightly free.

The tips of the vertical fins overlap before the mouth: the tail is distinct from the dorsal and anal, and the end of the caudal is rounded. The left ventral is much smaller than the right one which is united to the anal, and its rays nearly equal the longest ones of the latter.

Radii.—D. 81; A. 56; P. 9—9; V. 10—6; C. 18; including three on each side, which are shorter than the others.

Scales.—The fish is scaly throughout except the jaws, a small space round the nostrils, the gill-membranes and the limb of the left or under preoperculum. The pectoral and ventral fins are scaleless, and so are the membranes of the others, but the rays of the vertical fins are covered with soft scales on the upper side, and except some of the anterior rays of the dorsal and anal, on the under side also. The scales of the body are small and obtusely oval, with fan-like streaks on the base, and the semicircular edge of the small, rough, uncovered surface fringed with several acute, awl-shaped teeth. The scales on the under surface are softer, and have fewer and weaker teeth, so that they scarcely feel rough to the touch. The lateral line is scarcely perceptibly curved over the pectorals, and is thence continued straight on both sides of the body to the centre of the caudal, where it is lost between the two middle rays.

The fish after long maceration in spirits has a light brownish-grey colour above, with some minute dark specks widely dispersed over the surface. Many of these specks being formed by a dark line, on each side of a scale, with a connecting streak, resemble the letter H. There are no spots on the fins. The under surface is pale and spotless.

DIMENSIONS.

	In.	Lin.
Total length, caudal included	6	0
Greatest breadth, fins included	3	4
Length of head	1	4
Length from forehead to end of anal or dorsal	4	10
Length of right pectoral	0	$8\frac{1}{2}$
Length of longest rays of right ventral	0	$6\frac{1}{2}$
Length of left ventral	0	4
Length of longest rays of anal or dorsal	0	8
Length from tip of lower jaw to anus	1	2
Length of caudal	1	0

ANGUILLA AUSTRALIS (Nob.), *Van Diemen's Land Eel.—Anguilla australis,* Richardson, Zool. Proceed., March 9, 1841.

Ang. maxillâ inferiore longiore, pinnâ dorsi super anum incipienti, rictu oris magno.

This species was taken in the freshwaters of Van Diemen's Land by Mr. Lempriere. It differs from the common freshwater-eels of Europe, in the relative position of the first rays of the dorsal. When compared with an example of the Hampshire 'Snig-eel' (*A. mediorostris,* Yarrell), it is observed to have a broader and more obtuse snout, the space between the tubular nostrils being greater; the pectorals are lanceolate, not rounded; the height of the vertical fins is less, and the dorsal begins nearly over the anus, or within less than the twelfth of an inch anterior to it, while in the Snig the dorsal originates in a specimen of the same size fully two inches before the anus. The vent is also slightly nearer to the head than in the Snig, which is said by Mr. Yarrell to have that orifice as well as the pectorals and dorsal further forward than in the three other species or varieties of English eels which he describes, viz. the 'Sharp-nosed,' 'Broad-nosed' and 'Grig-eels[1]'. The minute deeply imbedded scales are narrowly oblong and obtuse at both ends. Behind the pectorals they are more remote and disposed irregularly, some vertically, and others transversely, at right angles to each other.

[1] *Anguilles long-bec, pimperneaux, et plat-bec.*—Reg. An. ii. p. 349.

Dimensions.

	In.	Lin.
Length from edge of upper jaw to tip of the caudal	17	1
Length from edge of upper jaw to beginning of anal	7	7⅓
Length from edge of upper jaw to centre of anus	7	6
Length from edge of upper jaw to beginning of dorsal	7	5⅓
Length from edge of upper jaw to branchial slit, or pectoral	2	1½
Length from edge of upper jaw to angle of mouth	0	7½
Length from edge of upper jaw to centre of the eye	0	5¼
Length of projection of lower jaw beyond the upper (mouth open)	0	1½
Breadth between the tubular nostrils	0	3½
Length of the pectorals	0	6½
Height of vertical fins	0	2¾
Height of occiput	0	10
Height of body	0	9½
Thickness of body	0	7½

Ostracion lenticularis (Nob.), *Lenticular Trunk-fish.—Ostracion lenticularis*, Richardson, Zool. Proceed. March 9, 1841.

Os. inermis, ovalis, compressus, dorso ventreque carinatis.

I am indebted to Dr. Andrew Smith for the liberty of describing two specimens of an Australian Trunk-fish, which are highly interesting as exhibiting a modification of form which has not been hitherto noticed to exist in this singular genus. In general structure this new species approaches most nearly to the sub-generic group characterized by J. E. Gray, Esq. under the appellation of '*Aracana*.' The Chinese *Aracana reevesii* of that author has a keeled back, and thus forms a link between the more common Van Diemen's Land *Aracanæ*, which have convex backs, more or less broad, and the lenticular form of the species at present under consideration. Dr. Smith's two specimens are evidently examples of one species at very different ages, and the epidermis having been mostly worn off them, scarcely any traces of the original colours remain. I received no account of their habits, but as the smallness of their fins and the strength and elasticity of their cuirass fit them for being tumbled about in the surf of a rocky coast, it is probable that, like the other Trunk-fish, they inhabit such places.

Form.—Much compressed, the greatest thickness measuring less than half the height. The profile of the body is an almost regular ellipse, whose transverse axis exceeds the vertical one by about one-fourth. The sides are convex and meet in acute mesial keels on the back and belly. The dorsal keel commences a little posterior to the pectorals, the nape being obtusely rounded and the space between the orbits nearly flat, or in the older specimen slightly concave, from the greater projection of the borders of the orbits. The general structure of the cuirass and the disposition of its parts is the same as in the *Aracanæ*. A slight degree of motion is permitted by a membranous line which extends from the angle of the lips to the branchial slit, and the cuirass is truncated posteriorly by a waving line which runs round the vertical fins so as to leave them all in soft membrane. The pectorals also stand in smooth membranous spaces. The tail is protected by the usual number of coarsely granular plates which form two rings.

The plates which compose the cuirass vary in size with their position, being smallest round the mouth and towards the dorsal and ventral ridges. They are mostly irregular hexagons, but many of them have a side more, and some one or two less. A wart-like umbo occupies the centre of each plate, as many ridges proceed from it as the plate has angles, and are continued to the centres of the contiguous plates. The plates are simply in contact with each other, their margins not being thickened, and when the epidermis is entire their boundaries are invisible; but the radiating ridges which connect their centres are very conspicuous, and divide the whole cuirass into triangular areas of various sizes, each area being common to three adjoining plates. The umbones and ridges are formed of rounded, crowded, or confluent grains, and are most elevated in the younger specimen. In the older fish they are attenuated and less prominent, and the areas of the triangles which have expanded with the increased size of the animal, are studded with small grains, which are scarcely discernible in the young one. There is likewise in the old fish a series of ridges more prominent than the rest, so disposed as to form nearly a straight line from beneath the pectoral to near the hinder part of the anal, with five or six of the umbones rising rather acutely into incipient spines; and there is also a less evident but more arched line of the same kind from the upper margin of the orbit to beneath the middle of the dorsal. These two lines evidently correspond to those which define the back and belly in the typical *Aracanæ*, and on which the strong spines of the cuirass stand. The principal lateral spine of the *Aracanæ* is represented in *Ostracion lenticularis*, when old by an acute *umbo* on the centre of each side, in the middle of the greatest vertical height, being rather above the level of the pectoral.

Radii.—P. 12; D. 10; A. 10; C. 11.

The fins are similar in form to those of the *Aracanæ*, but differ somewhat in the number of rays from the Van Diemen's Land species, which have eleven for the normal, though not invariable number of rays in all their fins. We have reckoned the first very short pectoral ray in the present species and in the *Aracanæ*.

The only remains of colour in either of Dr. Smith's specimens is an olive, ground tint near the back, some scattered, round blotches on the upper part of the body, and a few stripes of purplish-brown on the dorsal and caudal fins.

DIMENSIONS.

	In.	Lin.
Length from upper lip to tip of caudal fin of the older specimen	6	7
Length from upper lip to base of caudal fin	5	2
Length from upper lip to beginning of dorsal or anal	4	2½
Length from upper lip to pectoral fin	1	8½

	In.	Lin.
Length from upper lip to centre of orbit	1	4
Diameter of orbit	0	7
Height of dorsal	0	11
Height of anal	0	9½
Length of caudal lobes	1	3½
Length of central rays of caudal	1	1
Greatest vertical height of body	3	6½
Greatest thickness of body	1	7

OSTRACION AURITUS (Shaw), *Shaw's Sea-pig.*

Tab. IX. Figs. 1 and 2.

Os. (Aracana) ventre pallente unicolore; lateribus dorsoque lineis saturatis, rectis et curvis ornatis, quarum quinque sub oculo et tribus in basibus pinnarum verticalium.

This Trunk-fish, known locally like the other Australian species by the name of 'Sea-pig,' belongs to a section of the genus which has been named '*Aracana*' by Mr. Gray. In the 'Magazine of Zoology and Botany' for 1838 (p. 108), that gentleman describes five species of *Aracana*, viz. four from Van Diemen's Land, and one from the China seas. On an attentive examination of Shaw's original specimen of his *Ostracion auritus* with seven others, all in the British Museum (numbered from 39 to 47 inclusive), and with three of very different sizes sent from Port Arthur by Mr. Lempriere, I am inclined to believe that the species varies considerably with age, that the *Aracana lineata* (Gray) is the younger individual, and that the *O. striatus* of Shaw, of which I have seen no example, is not perhaps distinct.

In *Aracana* a section of the body is bounded by five flatly curved lines, the lateral ones being curved and meeting the back nearly at right angles, but the two lower ones which define the belly being inclined towards each other in an obtuse angle and forming at their junction a ventral keel, more or less prominent and obtuse, according to the age of the fish. The relative proportions of the sides to each other vary with the species, and in a lesser degree with age also. There are three strong bony spines at the junction of the back and side, the anterior one rising from the margin of the orbit, and three at the junction of the belly and side, the anterior one being nearly under the branchial slit. There is a seventh spine behind and above the level of the pectoral on the middle of the side, making with those on the other side of the fish fourteen in all. The number is not invariable, some of the inferior spines being occasionally absent in young specimens, and there is sometimes an additional one in the upper or under row, or in both. In the young the spines are for the most part more conical and pointed, and as they increase in length they become at the same time broader, thinner, and more curved.

The structure of the cuirass is essentially the same as in *Ostracion lenticularis* described above, but in the recent fish the epidermis conceals the limits of the plates, though the radiating lines of small grains which divide by their intersections the whole surface into triangular areas are conspicuous enough. There is always a smooth membranous line connecting the angle of the mouth with the lower end of the vertical branchial slit; also an irregular membranous space at the upper end of that slit, with some narrow stripes branching between the scales to the posterior border of the orbit, and admitting of a slight degree of motion in these parts. The cuirass terminates posteriorly on each side by an undulated line, which seems to vary in form in different species, and even in individuals of the same species. In our oldest example of *auritus* it commences at the anterior end of the dorsal, runs parallel to that fin to its termination, whence it descends in a shallow concave curve to the anal, and running forwards to the anus meets there with the corresponding limit of the cuirass of the opposite side. The space behind is thus made to include the three vertical fins and is filled up with membrane, but is more or less protected by detached plates, which vary with the species. In *auritus* a saddle-shaped cluster of small plates bestrides the tail closely behind the dorsal, a small heart-shaped one lies beneath near the anus, and the base of the caudal is armed with a ring of plates, which is narrowest on the sides. In the smallest specimens which we have seen of this species, each plate has a small rough cauliflower-like central wart, from whence elevated ridges radiate to the angles and inclose depressed areas. The abdominal plates show an elevated hexagonal bounding line. In older examples, among which is included Shaw's specimen, the radiating lines, though still conspicuous, are more distinctly perceived to be composed of obtuse conical grains, and the central grain, though continuing to be larger than the others, has lost its clustered form: the areas are also less depressed. In our largest individual, which is six inches and a half long and three and a half high, the grains are all so nearly equal in size and so equally distributed, and the areas so nearly even, that it is only on a few plates behind the pectoral that the radiation is readily perceptible, the whole surface being equally granular.

The profile of *Ostracion auritus* (excluding the tail) is sub-orbicular, the muzzle projecting conically before, the eye standing a little out of the round. The orbit is moderately large, round, and forms a gibbosity in the profile, which from thence to the mouth is slightly convex. From the under lip for a short distance backwards the under outline is concave, but the projecting obtuse abdominal keel, which begins before the line of the eye, is curved in an equal degree with the back. The back is narrower, and the keel of the belly less distinctly pronounced in the younger specimens. The eye is about twice its own diameter behind the tip of the upper lip, and about one diameter above the naked stripe which runs horizontally backwards from the corner of the mouth. Three rows of scales lie above this space on the cheek. The lips are tumid, naked, and plaited within; the orifice of the mouth is small, and there are five narrow, chisel-shaped umber-brown teeth on each intermaxillary, and eight on the lower jaw. In the young fish the teeth are fewer and further apart. There is a transverse velum in the upper and under jaw.

The branchial slit has a very narrow, smooth membranous margin: it is short, vertical, more than its own length below the level of the orbit, and only the breadth of a single small temporal scale behind it. The pectoral stands obliquely in an oval membranous space, which is separated from the gill-opening by a narrow plate.

Radii.—P. 11; D. 11; A. 11; C. 11.

The numbers of rays vary a little, there being in some individuals a ray more in one of the fins, in others one less: they are all articulated. The first pectoral ray is very short; the anterior rays of the vertical fins are simple, the others branched, and the three exterior caudal rays above and below are more closely approximated to each other and simpler than the rest. All the fins are rounded in outline.

Spines.—The anterior dorsal spine rises from the hinder half of the orbit, and the margin of the orbit being also elevated, the forehead when viewed in front appears to be deeply concave. The second dorsal spine is about mid-way between the orbit and dorsal fin, and the third is nearly equidistant from the second spine and that fin, consequently the two posterior spines are nearer to each other than the second is to the first. The foremost ventral spine is beneath the gill-opening, and is generally less than the others. The hindmost one is a very little before the anus, and the middle one is nearly opposite to the space between the two hinder dorsal ones. One of the specimens has five ventral spines on one side, but presents only the normal number of three on the other. The lateral spine is nearly under the posterior dorsal one. All the spines are finely striated lengthwise, both in young and old specimens.

Colour.—From long maceration in spirits the original tints of colour have doubtless perished in our specimens, but the configurations of their markings can be still traced with ease. The belly in all appears to have been of an uniform pale colour without spots or lines. A series of dark stripes, narrower than the intervening pale spaces, runs backwards from the lips. There are five of these lines beneath the orbit; the lowest of which originates at the under lip and marks out backwards the junction of the sides and belly: the next one comes from the angle of the mouth, and the third from the upper lip, and runs in the naked line of the cheek: both these pass under the pectoral fin towards the anal. The two other cheek-lines, as well as higher ones which are cut by the orbit, cross the forehead to join their fellows, and in their course backwards over the back and sides they are variously undulated and even spirally curved, the exact pattern varying on different sides of the same individual. Three of these dark lines show conspicuously on the smooth naked spaces which inclose the dorsal and anal fins; and five on the tail, of which three reach the bases of the caudal rays. When the younger specimens were newly taken from the alcohol, the pale ground colour had a pearly lilac tint, and the dark lines were purplish-brown. In the old specimens a brown epidermis obscures the markings and darkens the belly. The fin membranes are destitute of colour. Judging from the number of specimens in Mr. Lempriere's collection and in the British Museum, this appears to be the most common species.

DIMENSIONS.

	Lin.	In.
Total length, caudal included	6	6
Length from mouth to lateral spine	3	3
Length from mouth to gill-opening	1	7½
Length from mouth to centre of eye	1	5½
Diameter of eye	0	5
Diameter of largest specimen	0	7
Length of dorsal spines	1	0
Length of pectorals	1	0
Height of dorsal	1	0
Height of anal	0	8
Length of tail between cuirass and caudal	1	0
Length of caudal fin	1	1
Vertical diameter of body	3	3

OTRACION SPILOGASTER (Nob.), *Spot-bellied Pig-fish.—Ostracion spilogaster*, Richardson, Zool. Proceed., March 10, 1841.

Tab. X. Fig. 1.

Os. (Aracana) ventre maculato; lateribus dorsoque lineis interruptis vittatis, quarum quatuor sub oculo, tribusque in basibus pinnarum dorsi et ani et tribus anastomosantibus propè finem pinnæ caudæ.

This species resembles the preceding in form, but its profile is still more oval, the muzzle projecting less beyond the general curve; and the under jaw in particular unites more evenly with the profile of the belly. The forehead is concave though narrower than that of *auritus*, and there is a gibbosity of the cuirass immediately before the dorsal, which is also perceptible in *auritus*. The spines are rather smaller than in *auritus*, and there is only a rudimentary anterior ventral one in our solitary example of *spilogaster*. The grains which roughen the surface of the cuirass encroach on the base of the spines, which is not the case in *auritus*. There is a smooth, membranous furrow running from the anus to the middle of the ventral keel, which may possibly be an individual peculiarity. The cuirass terminates rather sooner than in *auritus*, as it does not pass the middle of the anal and dorsal fins, but its bounding line exhibits nearly the same curves. The small grains which cover the hexagonal plates closely, show less appearance of radiation than in our oldest specimen of *auritus*. A section of body is more compressed than that of the latter.

Radii.—P 11; D. 11; A. 11; C. 11.

The first ray of the pectoral is still shorter than in *auritus*.

Colour.—The belly is pale blue or white, with oval and round, moderately large brown spots scattered over it. Under the eye there are four pale stripes, not so broad as the intervening ground colour, which is purplish brown on the head, sides and back. Two of the stripes pass from the mouth beneath the pectorals, and two cross the nose between the eye and mouth. The stripes are prolonged over the body by irregular detached spots, which again become more continuous on the tail and bases of the vertical fins. There are five stripes in all on each side of the tail, three of which are continued into the caudal fin, where they anastomose with each other, and are finally connected to each other within a fourth of the end of the fin by an arched vertical stripe. This stripe, and the lateral ones with which it unites, are parallel to the edges of the fin, which is even posteriorly, with the corners rounded. In *auritus* the caudal is rounded at the end. There are three stripes on the bases of the dorsal and ventral, and the spots are continued up the spines.

DIMENSIONS.

	In.	Lin.
Total length, caudal included	6	6
Length from mouth to lateral spine	2	10
Length from mouth to gill-opening	1	6
Length from mouth to centre of eye	1	$3\frac{1}{2}$
Diameter of eye	0	$4\frac{1}{2}$
Length of dorsal spine	0	5
Length of pectorals	1	0
Height of dorsal	1	$0\frac{1}{2}$
Height of anal	0	10
Length of tail from cuirass to caudal	1	2
Length of caudal fin	1	2
Vertical diameter of body	3	1
Breadth of back	1	$0\frac{1}{2}$

OSTRACION FLAVIGASTER (Gray), *Yellow-bellied Pig-fish.—Aracana flavigaster*, Gray, Mag. Zool. and Bot. 1138, p. 108; British Mus. No. 38.

Tab. XI. Fig. 1.

Ostracion (Aracana) ventre pallido unicolore, lateribus dorsoque lineis saturatis percursis, quarum octo sub oculo cum totidem lineis pallidis interjacentibus; in basi pinnæ caudæ lineis quinque pallidis et tribus in basibus pinnarum dorsi et caudæ.

This Trunk-fish differs from the two preceding species in the cranium being nearly flat instead of very concave between the very long orbitar spines. The facial profile is slightly convex; the pectoral is somewhat pointed, its uppermost rays being twice the length of the lowest ones, and the caudal fin is slightly lunated at the end. The plates of the cuirass are roughened by small obtuse grains, not so crowded as in *auritus*, and not disposed in a distinct radiated manner. On the belly the plates have slightly elevated margins.

The belly is pale, with no other markings than a slight darkening in the centre of each plate. The upper parts are marked with alternate narrow lines of dark brown and pale gray or lilac, running from before backwards in a more or less wavy manner. Beneath the orbit the pale and dark lines are of equal width, and there are about eight of each, but posteriorly the brown stripes are wider than the pale ones, and encircle and form blotches on the spines. There are three white stripes on the base of the dorsal, as many on the base of the anal, and eleven on the tail, five of which cross the base of the caudal. The membranes of the fins are colourless, except a slight cloudiness in the fore-part of the anal and dorsal. The lines above the mouth meet their fellows on the forehead and fore-part of the back, as in the preceding species.

These colours are described from the dried specimens. Mr. Gray makes out the belly and under lip to be yellow.

Ostracion ornatus (Gray), *Handsome Pig-fish.—Aracana ornata*, Gray, Mag. of Zool. and Bot. and Brit. Mus., No. 36.

Tab. X. Fig. 2.

Os. (Aracana) lateribus dorsoque lineis albidis tessellatis; facie ventreque lineis purpureis, fuscis et albis, numerosis, variis; vittis sex prope finem pinnæ caudæ anastomosantibus; naso mentoque convexo carinatis.

The spines in this species are rather short, and in some individuals most of them are merely rudimentary. The forehead between the orbitar spines is very convex, and the sides and belly round into each other, not meeting at so decided an angle as in the preceding species. The grains are more crowded on the plates of the cuirass than in *auritus*. The nose from before the orbitar spines to the mouth has an elevated, obtuse, and thickly granular keel, and the chin which is convex in profile is also keeled, though less conspicuously.

The sides and back are divided into small hexagonal spaces by pale or whitish lines, the areas being dark brown with a white central speck. Seven short purplish lines cross the sides of the head, running as far back as the eye: they are separated by brown spaces, each of which is divided by a fine central white line parallel to the others. None of the lines cross the facial keel. There are about as many similar stripes beneath the angle of the mouth, separated from their fellows by the mental keel, but continued along the belly to the anal, the white lines becoming wider posteriorly. The lower lines encroach on the ventral keel, and also cross the bases of the fins; but on the membranes the colours appear to have faded, there being merely a few brownish clouds remaining on the forepart of the dorsal and anal. There are six dark longitudinal stripes united by a subterminal band in the same way as in *spilogaster*. The colours are described from dried specimens.

No examples of *ornatus* or *flavigaster* are contained in Mr. Lempriere's collection, but he alludes either to them or to similarly striped *Ostracions* in his notes, and the specimens in the British Museum were actually brought from Van Diemen's Land.

Mr. Gray also describes a Chinese species (*Ostracion reevesii*) which is allied to the

Australian ones, but differs from them in the membranous spaces at the bases of the fins being protected by small grains which do not destroy their flexibility. The thickly granular cuirass is traversed longitudinally by smooth (not granular) stripes, on which there are traces of fine coloured lines. There are four such stripes between the eye and angle of the mouth. The form of the dried specimen is compressed and high, the back being partly keeled.

MONACANTHUS RUDIS (Nob.), *Gray Monacanthus.*—*Monacanthus rudis*, Richardson, Zool. Proceed. March 10, 1840.

M. (*nec paleari extensivo, nec caudâ setosâ, nec corpore papilloso vel penicilligero præditus*;) *retro-scaber; rostro mediocri; dentibus latis in utrâque maxillâ serie duplici ordinatis, decem nempè superioribus, sex inferioribus; spinâ dorsali, subulatâ retrò-dentatâ; pinnâ caudæ rotundatâ.*

Radii.—B. 6—6; P. 14; D. 2—35; A. 34; C. 12.

This is most probably number twenty-five on Mr. Lempriere's list, and if so is an edible fish, being brought to the table at Van Diemen's Land after being skinned. The skin is very loose as in the *Aleuteres* described below, gliding readily over the tendinous fascia which covers the muscles, and being attached firmly, merely at the gill-openings, mouth and bases of the fins. It does not appear however that the animal has the power of inflating it like the Diodons. Mr. Lempriere says that the fish has a grey colour, and the specimens when taken from the spirits had an uniform dark greyish-brown hue, but after being macerated for a short time in a weak solution of potass to remove the hardened mucus from the skin, the following indications of colour appeared. A dark ring surrounded the snout, immediately behind the lips. A dark band curved over the preoperculum to meet its fellow on the chin, two longitudinal bands showed themselves on the upper parts of the sides, reaching to the caudal fin, one of them being on a level with the eye, the other commencing above the gill-opening and running parallel to it. A dark patch could also be perceived on the base of the pectorals, and some diffused dark clouding on the abdomen, which posteriorly, and on the tail formed a band parallel to the two upper ones. There appeared also to be many small brownish spots spread regularly over the lower half of the body. How far these appearances depend upon the real configurations of colour, or originated solely in the action of the potass upon the different textures of the skin, I cannot say. The species ranks in the last group of *Monacanthi* mentioned in the *Règne Animal*, viz. that group which wants the characteristics of the three preceding ones. The general form does not differ from Forster's figure of *B. scaber* in the Banksian Library, Bl. Schn. p. 477, and its fin rays nearly correspond; but in the figure there are some spinous serratures indicated between the point of the pelvic bone and the anus which do not exist in the specimen. A drawing which I received from Dr. Lhotzsky of a *Monacanthus*, also taken at Port Arthur, has yellow fins, and a purplish and grey body, and comes near Forster's figure.

Form.—Compressed, the profile being irregularly oval (caudal excluded), and having a vertical diameter equal to half its longitudinal one. The height of the tail is about one-fifth of that of the body, and its length comprised between the three vertical fins equals one-tenth of the entire length of the fish, caudal fin included. The profile of the head is nearly straight from the dorsal spine to the lips: the under profile is more convex, though somewhat undulated, and when the pelvic bones are fully depressed the belly is protuberant, while the back between the first and second dorsals is nearly straight. The thickness of the body is equal to one-third of the height.

The whole skin is densely studded with minute conical spines directed backwards. On the sides these spines appear when examined by the microscope to be arranged in innumerable vertical or inclined rows, five or six in a row, with a few solitary ones between. This arrangement is more distinctly seen on the belly, where the skin is lax, and the spaces between the rows or scales as they may be termed, wider. In many places the rows are double, and the little spines more acute. Round the eye, about the gill-openings, and on the head generally, the spines are shorter, more obtuse, and either solitary, or so clustered that their separation into rows can no longer be made out. In the axilla of the pectoral fin, the spines are obtuse and very minute, but their distribution in separate rows or scales is very readily seen there. To the naked eye the skin merely appears to have a close-shaven villous structure.

Rays.—B. 6–6; D. 2|–35; A. 34; C. 12; P. 14.

The dorsal spine stands over the posterior half of the orbit, and above the gill-opening. It is rounded and tapering with a groove behind, which runs nearly to its tip, and is armed on its margins with spinous teeth pointing downwards. The anterior surface of the spine is closely studded with very obtuse, minute teeth, the two middle rows being larger than the rest. There is a short spine, or bone involved in the membrane behind the principal spine, and serving as a trigger to it, to fix it in an inclined or erect position. This small spine requires to be depressed before the principal one can fall back into the dorsal groove. The second dorsal commences a little anterior to the vent and terminates opposite to the end of the anal. Both these fins are moderately arched, being highest at the commencement of the second third of their lengths. The caudal is regularly rounded when expanded, and when closed its rays are all equal in length. The rays of all the fins are rough at the base, the asperities of the pectoral however being so minute as to require a good lens to exhibit them. On the caudal the minute spines are very crowded and regular, and extend to the tips of the rays, yet so that the broad rough surfaces of the alternate rays only appear on each side of the fin; but the uppermost and undermost ray are simple and broadly rough on both sides; the others are divided. The rays of the second dorsal, anal and pectoral, are all simple and jointed. The pelvic bone projects very little through the integuments, showing merely a small knob, rough with minute obtuse spinous points. The integuments of the belly are somewhat lax, giving a little play to the pelvic bone, but there is no extensible dewlap.

There are ten broad chisel-shaped teeth, more or less acuminated, belonging to the upper jaw, and six with crescentic cutting edges, and one of the angles a little stronger, implanted in the lower jaw. The posterior tooth on each side of the upper jaw has a thin rounded edge, and appears at the angle of the mouth, overlapping the outer teeth of the under jaw. The central pair of teeth both above and below converge at their points.

Osteology.—The intermaxillaries, closely applied in an even line to each other, are convex above, dilated inferiorly, and joined by ginglymus to the broad end of the ethmoid by the interposition of a thin articular cartilage. The teeth are implanted into them by sockets. The maxillary appears to have no motion: its upper end is closely fitted to a triangular lateral process of the ethmoid[1], and its lower half to the upper and outer edge of the intermaxillary. No suborbitars could be detected. The preoperculum is much developed, a strong inferior limb running forwards with a slight inclination upwards to the articulation of the lower jaw, and the upper limb running backwards at a very obtuse angle with the former to the lower margin of the orbit. The lower edge is thin and broad, and much rounded at the angle. The operculum and suboperculum are elliptical; the latter is the broadest of the two, and forms the greater part of the anterior border of the gill-opening: it is not so wide as the border of the preoperculum. The under branchiostegous ray is broad, more compressed and more curved than the others, which are slender.

Supra-scapular consolidated with the cranium, so as not to be distinguishable. Scapular oval, articulated to the cranium, and lying wholly on the exterior side of the coracoid which runs up behind it to join the cranium. The third piece of the humeral chain, named 'humerus' by Cuvier, but 'coracoid bone' in the last edition of the 'Anatomie Comparée,' is very large, and forms the whole posterior edge of the gill-opening. Its interior plate is very broad, meeting its fellow of the opposite at the mesial isthmus, and resting firmly against it. The radius (Cuv.) is also developed into a broad plate with a strong elevated edge, and is applied along the under side of the coracoid up to the isthmus, serving to enlarge the fossa for the reception of the muscles which move the fin. The ulna on the other hand is small, being in proportion to the moderate-sized pectoral fin. The styloid bone, strong, long, flat, and linear, is articulated at its upper end to the interior surface of the elbow, which the coracoid forms over the pectoral fin. The pelvic bone is long and consists of an upper keel, and a less extensive under one united by a thin vertical plate. The bone emerges anteriorly

[1] In Tetraodon, this angular process, instead of lying further back than the end of the ethmoid, projects beyond it, and the maxillary is articulated to it, not by its extreme upper end, but by a shoulder. The maxillary itself is united by bone for a considerable part of its length to the intermaxillary, but its rounded end projects beyond that line at the angle of the mouth. The dilated lower end of the intermaxillary of *Monacanthus rudis* resembles the maxillary of Tetraodon in form; but if it is to be considered as actually representing that bone, it will differ in being still more intimately consolidated with the intermaxillary, and also in furnishing a socket for the last tooth of the upper jaw.

from between the mesial ends of the coracoid bones, and its two keels converge posteriorly to terminate in a rather thin obtuse tip: to this is attached the small, hard, but rather cartilaginous-looking knob which projects through the integuments.

The dorsal spine stands on the cranium between the orbits behind a short mesial crest; it moves backwards on a small bone, itself moveable, to which the second minute ray belongs. This small bone must fall backwards into a pit of the interparietal crest, before the spine can be made to recline in the large furrow formed by that crest. The spout-shaped interparietal crest tapers backwards to an acute point, and projects nearly half its own length behind the cranium.

There are eighteen vertebræ, the nine anterior ones having strong, but not long, nearly horizontal ribs. The six first have broad triangular horizontal lateral processes; the seventh, eighth, and ninth, and five succeeding ones, have descending inferior spinous processes, which interlock with the interspinous bones of the anal. The lower spinous process of the fifteenth vertebra lies between the two last interspinous bones of the anal, while its upper spinous process is just posterior to the dorsal fin. Three upper spinous processes interpose between the cranium and the first dorsal interspinous bone. The interspinous bones above and below are joined to one another by finely undulating or serrated sutures, connecting the thin diaphanous plates which spring from before and behind their midribs. At the bases of the dorsal and anal fins, the interspinous bones are furnished with short transverse processes, giving passages between them to, and affording fulcra for the muscles which move the rays. The very strong first interspinous bone of the anal is sheathed laterally and before at its upper end by the descending spinous processes of the seventh vertebra: its lower end dilates into a stout, flattish rounded shoulder. There are three vertebræ and the interspinous bones of the caudal behind the anal and dorsal fins.

Dimensions.

	In.	Lin.
Length from the tips of the teeth to extremity of caudal fin	10	0
Length from the tips of the teeth to base of do.	8	9
Length from the tips of the teeth to end of anal	7	6½
Length from the tips of the teeth to end of dorsal	7	4
Length from the tips of the teeth to beginning of anal	5	6½
Length from the tips of the teeth to anus	5	4
Length from the tips of the teeth to beginning of second dorsal	5	0
Length from the tips of the teeth to tips of pelvic bone	4	8
Length from the tips of the teeth to base of pectorals	3	0
Length from the tips of the teeth to dorsal spine	2	10
Length from the tips of the teeth to gill-opening	2	8
Length from the tips of the teeth to centre of eye	2	8
Height of body at the pelvis	4	5

	In.	Lin.
Thickness of body at the pelvis	1	6
Distance from dorsal or anal to caudal	0	11
Length of exterior caudal rays	1	$3\frac{1}{2}$
Height of dorsal or anal	0	$9\frac{1}{2}$
Length of anal	2	6
Length of second dorsal	2	10
Height of dorsal spine	1	6
Length of pectoral	0	8
Diameter of orbit	0	$7\frac{1}{2}$
Height or length of gill-opening	0	9
Distance between dorsal spine and second dorsal	2	2

The drawing made by a convict at Port Arthur under Dr. Lhotsky's inspection, represents a Monacanthus very similar to the above as to general form, but with the numbers of the rays as follows:—D. 1| — 37 ; A. 37 ; C. 11. The dorsal spine is represented as awl-shaped, slightly curved and smooth, and the point of the pelvic bone more pointed than in *rudis*. The body is painted blackish-green above, with a purple streak under the second dorsal, reaching to the caudal. Lighter green tints prevail on the belly, and the second dorsal and anal are grass-green. The cheeks exhibit a mixture of orange and green, and there is a black bar on the end of the caudal, its rays being green and purple. This fin is truncated by two shallow crescentic curves, meeting in a rounded centre. A caudal of this form, with a black bar at the end, is found in the Port Jackson *spilomelanurus*, but the numbers of the rays of that species differ widely from those in Dr. Lhotsky's figure.

ALEUTERES MACULOSUS (Nob.), *Speckled Leather Jacket.*

Aleuteres maculosus, Richardson, Zool. Proceed., March 10, 1840.

Al. retro-scaber, subovalis, ventre prominulo; angulis quatuor spinæ dorsalis retro uncinato-dentatis; pinnâ caudæ rotundatâ, sub finem nigro fasciatâ; corpore (colore murino?) nebuloso-guttato.

This small fish is, like its congeners, named 'Leather Jacket' at Port Arthur. It is used for food.

Form.—Compressed; profile irregularly elliptical, the greatest height being equal to rather more than half the distance from the mouth to the ends of the dorsal and anal fins. Behind these fins, the tail tapers slightly, and near the caudal its height is about one-fifth of that of the body. The mouth is rendered slightly oblique by the greater projection of the lower jaw, is filled with broad teeth, and forms an obtuse termination to the head. The profile is nearly straight from the upper lip to the dorsal spine, and but a little more arched from the under lip to the end of the pelvic bone, which however descends farther below the axis of the fish than the back rises. The belly is rounded and slightly prominent, and the anal and dorsal spring from arched bases. The naked trunk of the tail forms more than one-fifth of the total length of the fish, caudal excluded. The dorsal and anal fins are arched in outline, the curve in both being more sudden anteriorly; the caudal is rounded.

Rays.—D. 2| — 34; A. 32; C. 12; P. 11 or 12.

The dorsal spine is quadrangular, tapering and acute, and is armed on each angle by a row of sharp hooks turned downwards. It stands between the posterior halves of the orbits and over the gill-openings, which are short, and do not descend lower than the upper edge of the pectoral. The pelvic bone shows its form through the skin, but its tip does not perforate the integuments.

The whole body is densely covered with minute, smooth globular warts, each supporting a very small spine pointing backwards, and rendering the skin rough to the touch when the finger is drawn forwards. The minute spines are more erect and a little longer on the margins of the occipital furrow which receives the spine, on the belly and on the pelvic bone, particularly on its tip. These dermal spines are invisible to the naked eye; but when viewed through a lens, they appear to be very regular and beautiful objects, the integuments between them being finely spotted.

Colour.—Dark on the upper parts, more silvery towards the anal and on all the parts below the level of the pectoral. Many roundish but irregular darker spots are scattered in cloud-like patches on the sides of the head, body, and tail, but none of them are beneath the line of the pectorals. The ground colour after long maceration in spirits is clove-brown, the spots being a deeper tint of the same. Near the end of the caudal a narrow dark band is obscurely marked.

Dimensions.

	In.	Lin.
Length from the tips of the teeth to the extremity of the caudal fin	4	5
Length from the tips of the teeth to the base of do.	3	8
Length from the tips of the teeth to the end of anal	3	$0\frac{1}{3}$
Length from the tips of the teeth to the end of dorsal	2	11
Length from the tips of the teeth to the beginning of anal	2	2
Length from the tips of the teeth to the anus	2	1
Length from the tips of the teeth to the beginning of dorsal	1	$11\frac{1}{3}$
Length from the tips of the teeth to the tip of pelvic bone	1	10
Length from the tips of the teeth to the dorsal spine	1	0
Length from the tips of the teeth to the centre of orbit	0	10
Length from the tips of the teeth to the base of pectoral	1	0
Length from the tips of the teeth to the gill-opening	0	$10\frac{3}{4}$
Diameter of the orbit	0	3
Height of the dorsal spine	1	0
Height of the second dorsal or anal	0	5

	In.	Lin.
Length of pectorals	0	$5\frac{1}{4}$
Length of second dorsal	1	$2\frac{1}{2}$
Length of anal	1	1
Length of caudal	0	10
Height of body at the point of the pelvic bone	1	8
Height of the tail near the caudal fin	0	3
Length of naked tail between the vertical fins	0	7
Thickness of the body	0	6

Aleuteres paragaudatus (Nob.), *Trim Leather Jacket.*

Aleuteres paragaudatus, Richardson, Zool. Proceed., March 10, 1840.

Al. retro-scaber; dorso ferè recto ab ore ad pinnam secundam; ventre regulariter convexo; pinnâ caudæ rotundatâ sub finem nigro fasciatâ; colore corporis murino?; fasciâ pallidâ (flavâ) è mento per pinnam pectoralem medio in latere tractâ, sub quâ lineâ cæruleâ; lineâ alterâ cæruleâ è mento per oculum et ultrà extensâ; corpore subtus et posticè guttis cæruleis pulchrè interstincto.

We have named this very handsome *Aleuteres* in allusion to the gay striped vestments of the Roman ladies termed '*Paragaudæ*.' It appears to be common at Port Arthur; and Mr. Lempriere remarks, that when recent it is ornamented in a beautiful manner on the sides with blue and yellow stripes, and on the tail with blue spots. The abdomen of one specimen was distended by a large *Idotea* (Fabr.) full of roe, its tail protruding at the anus; and the other had a smaller specimen of the same insect in its gut. Even the smallest of these *Idoteæ* was many times larger than the size of the mouth, and could scarcely have made its way out by the anus. This *Aleuteres* is said not to exceed six inches in length.

Form.—In the dorsal spine, dermal asperities, and shape of the fins and tail, this species exactly resembles *A. maculosus*; but the body is more elongated, the back in particular being more nearly straight, up to the second dorsal, so that its profile from the mouth forms a very acute angle with the axis of the fish. The belly is not so prominent as in *maculosus*, the curve of its profile being regular from the under jaw to the end of the anal fin. The height of the body, at the point of the pelvic bone, is exactly half the length of the distance between the mouth and the setting on of the stump of the tail behind the anal and dorsal fins. The length of that portion of the tail is about one-sixth of the total length of the fish, caudal included, while its height is equal to one-fourth of that of the body. The under jaw is longer than the upper one, giving the mouth the same obliquity as in *maculosus*.

Rays.—Br. 6 — 6; P. 12; D. 2| — 34; A. 32; C. 12.

The second spine of the first dorsal is very slender and short, as in *maculosus*. The first ray of the second dorsal is articulated at the tip, but it requires the aid of a good lens to see the joints.

Colour.—The body, after maceration in spirits, has a dark clove-brown tint, a little lighter and more silvery towards the belly. A moderately broad pale (yellow ?) stripe commences on the chin, and keeping of the same width throughout, passes backwards by the under end of the gill-opening, and upper part of the pectoral, to terminate on the side over the fore-quarter of the anal fin. It is bounded beneath by a narrower, greyish blue line, edged above with black, and after passing the pectoral ending in a row of spots. A similar blue line commences beneath the mouth, above the yellow band, and arching upwards over the cheek and through the lower third of the cheeks, continues its course in a horizontal direction backwards, tapering off, and finally ending in a series of spots before it comes opposite to the termination of the yellow band. These lines unite on the chin with their fellows of the other side. There are no spots within the space included between the blue lines, nor on the back before the second dorsal; but all the rest of the body and tail is ornamented with perfectly round, greyish-blue pearly spots, each well defined by a dark margin. The rows of spots which run along the base of the second dorsal are larger than the rest, and those on the belly are smaller than those on the tail. There is a narrow vertical black bar near the end of the caudal fin.

Osteology.—Teeth above and below thin and evenly truncated at the tips, not crescentic or acuminated as in *Monacanthus rudis*, but otherwise similarly arranged. Summit of the skull before the spine of first dorsal formed of a short mesial ridge and two longer lateral ones, the intervening spaces being membranous. Structure of the jaws the same as in *Monacanthus rudis*, the maxillary being rather more slender. The cutting edges of the teeth are even, not lunated. The bones of the skull generally are much more fibrous in their structure and delicate in their tissue. The broad border of the preoperculum, and the two other opercular pieces are thin, diaphanous and almost membranous. The styloid and pelvic bones resemble those of *Monacanthus*, except that the small knob of the latter is retained under the integuments, and is armed exteriorly by purely dermal spines.

There are twenty vertebræ, about eight or nine of them carrying short, slender ribs. The seventh vertebra receives the end of the first interspinous bone of the anal as in *Monacanthus rudis*, but the obtuse lateral processes of that vertebra are bent downwards, anterior to the interspinous bone, instead of closely sheathing it, as in the *Monacanthus*. Some of the superior spinous processes are finely serrated. The interspinous bones are joined to each other by suture as in the species just named; and as in it, there are three spinous processes before the second dorsal. The spinous processes and interspinous bones alternate at the beginning of that fin, but the latter increase posteriorly until there are four or more between each pair of interspinous bones.

DIMENSIONS.

	1st spec. In.	1st spec. Lin.	2nd spec. In.	2nd spec. Lin.
Length from tips of the teeth to extremity of the caudal fin	5	7	4	2
Length from tips of the teeth to base of do.	4	7	3	4
Length from tips of the teeth to end of anal	3	9	2	9
Length from tips of the teeth to end of dorsal	3	$7\frac{1}{2}$	2	8
Length from tips of the teeth to beginning of anal	2	$5\frac{1}{2}$	1	11
Length from tips of the teeth to anus	2	3	1	$9\frac{1}{4}$
Length from tips of the teeth to beginning of second dorsal	2	$2\frac{1}{3}$	1	$8\frac{1}{2}$
Length from tips of the teeth to point of pelvic bone	2	1	1	$7\frac{1}{2}$
Length from tips of the teeth to dorsal spine	1	$2\frac{1}{2}$	0	11
Length from tips of the teeth to base of pectoral	1	$2\frac{1}{2}$	0	11
Length from tips of the teeth to gill-opening	1	$1\frac{1}{4}$	0	$10\frac{3}{4}$
Length from tips of the teeth to centre of orbit	1	$0\frac{1}{4}$	0	$9\frac{1}{2}$
Diameter of orbit	0	4	0	$3\frac{1}{2}$
Height of dorsal spine	0	7	0	6
Height of second dorsal or anal (anterior third)	0	$6\frac{1}{2}$	0	5
Length of pectorals	0	6	0	$4\frac{1}{2}$
Length of second dorsal	1	7	1	$1\frac{3}{4}$
Length of anal	1	5	0	11
Length of caudal	0	$10\frac{1}{2}$	0	9
Height of body at the point of the pelvic bone	1	8	1	$2\frac{1}{2}$
Height of tail near the caudal fin	0	$3\frac{1}{2}$	0	3
Length of stump of tail (between the three vertical fins)	0	9	0	$6\frac{1}{2}$
Thickness of the body	0	6	0	$4\frac{1}{2}$

CALLORHYNCHUS TASMANIUS (Nob.), *Tasmanian Elephant Fish.*

Callorhynchus tasmanius, Richardson, Zool. Proceed., March 10, 1841.

C. pinnis pectoralibus ventrales haud attingentibus; pinnâ dorsi secundâ ponè ventrales incipienti, ante lobum anteriorem pinnæ caudæ desinenti; maculâ oblongâ lacteâ in latere supra pinnam pectoralem.

This fish differs from *C. antarcticus* in the tips of the pectoral fins falling considerably short of the base of the ventrals, and in the second dorsal terminating anterior to the commencement of the under caudal fin[1]. There may be also other differences, but as I have no specimen of *antarcticus* for comparison, and merely the small figures of Shaw and M. Guerin to refer to, I am unable to point them out. The *C. smythii* of Bennet, founded on a drawing made by the officer whose name it bears, resembles our specimen in the relative shortness of the pectorals; but the second dorsal is so unlike that of

[1] Cuv. *Reg. An.* says of *C. antarcticus*, "*La deuxième dorsale commence sur les ventrales, et finit vis-à-vis le commencement de celle qui garnit le dessous de la queue.*"

tasmanius in form, and the tail so much shorter in proportion, that I cannot venture to refer them both to the same species. Their habitats are remote from each other, *C. smythii* having been taken at Valparaiso.

A single male specimen of *C. tasmanius* was contained in Mr. Lempriere's first collection, and recently I have received from him a female one, preserved in brine. The stomachs contained bivalve shells and barnacles much broken down.

Form closely resembling that of *antarcticus*. The snout is much compressed, and has a thin depending hoe-shaped appendage. Dental plates, four in the upper jaw and two below, with even edges. Exterior lips prominent, enclosing the mouth and nostrils, meeting at the bridle which separates the nasal orifices, and spreading out at the angles of the mouth, where they are curiously folded, then becoming thicker to form the lower lip, which is equally broad, and appears to be finely villous, as do also the parts about the nostrils, when the mucus which lines them is scraped away. The club-shaped appendage on the head is armed at the end and beneath with small, somewhat curved spines. It is received into a groove whose anterior margin is also rough with spines. The large oval eye is placed near the forehead, but does not trench on its profile. Two raised lines of pores run on each side of the snout, near its margin, separating as they proceed backwards, so that one passes over and the other under the orbit, behind which they are joined to one another, and also to their fellows on the opposite side of the head, by a transverse line which makes a backward loop on the nape. Three branches spring from the lower line, one of them stretching forwards to the side of the snout; another dipping directly to the angle of the mouth, and the third going obliquely backwards to the gill-openings, before which, on the throat, it forms a junction with its fellow of the opposite side. There are three conspicuous pores closely adjoining each of the three anterior lines on the cheek, also nine or ten above the orbit. The lateral line commencing at the angle of junction of those lines which pass over and under the orbit, and running nearer to the back than to the belly, exhibits many small undulations in its course, with two or three more remarkable ones before the ventrals. When it arrives over the first under caudal, it crosses the tail obliquely, and a little behind the beginning of the second caudal, it makes a more sudden curve, and keeps close to the bases of the rays of that fin up to the tip of the tail. The branchial opening is a single orifice at the base of each pectoral, and is bound to its fellow of the opposite side by a fold of skin which crosses the hyoidal isthmus.

The dorsal spine is articulated to a large winged process of the first vertebra, which rises higher than the adjoining occipital crest. The spine is very strong, being fully half an inch broad below. It is compressed with an acute curved edge anteriorly, a straight grooved back posteriorly, and tapers at the summit into a cylindrical rather obtuse point. Except the tip which appears worn, it is entirely covered with membrane, and shows no vestiges whatever of the serratures behind the point represented in Guerin's figure of *antarcticus*, or in that of *C. smythii* in the zoology of Beechey's voyage[1]. The membrane near the base of the anterior edge of the spine feels granular to the touch, probably the effect of corrugation by the alcohol, but the bone is smooth. The fin is closely attached to the groove of the spine, the rays being about one-fourth part shorter, but a slip of membrane runs up to near the tip. The base of the fin is fleshy, and the rays are too fine and close to be enumerated. A thin membrane attaches the posterior part of the fin to the back, but the point of the spine when laid down reaches behind it. The second dorsal commences behind the base of the ventrals, or nearly opposite to the posterior verge of the anus. It has a triangular elevation which occupies more than the anterior third of the fin, and the fin is suddenly curved into the form of narrow and slightly decreasing edging of the back, which terminates about an inch before the first under caudal. Behind it the summit of the back is flat, but not broad up to the commencement of the upper caudal. The first under caudal is triangular and slightly falcate, its height exceeding twice the length of its own base and being greater than that of the second dorsal. Immediately behind it, but distinctly separated from it by a little pit, rises the second caudal by a lobe nearly as high, but which gradually lowers in a falcate manner until it ends in the acute tip of the tail. The upper caudal being exactly opposite to the whole length of the second under one, is at its commencement merely a thick ridge of skin, which gradually narrows as it approaches the tip of the tail, the rays at the same time becoming more apparent. The pectorals have a scalene triangular form, with the inferior angle rounded off, and are more pointed, but neither so large nor so broad as those represented in Shaw's figure of *antarcticus* (Gen. Zool.). The oval cartilaginous plates which occupy the cavities lying before the ventrals are covered on their posterior halves by small spiny teeth, each tooth being composed of two rows of from three to six pectinated points directed towards the head. The claspers are as long as the ventrals. The female wants these claspers and plates, and the knob on the forehead. The ventrals in her are cut nearly even behind, but are broader on the exterior than on the mesial edge.

The colours of the male were not noted, but the female, when newly taken from the brine in which it had been well-preserved, had a general light grayish-nacry or silvery tint blending into blackish-gray along the back. The lateral line traversed an ill-defined dark stripe, and on the side above the pectoral there was a large oblong, milk-white patch, which had also a dark border that gradually softened off into the general hue. The fins and the top of the head were also dark.

The subjoined table of dimensions will furnish the means of ascertaining the proportions of the members for comparison with other species, but the male not having been measured till after it was mounted, I have been compelled to omit some of the results, as being uncertain.

Anatomical observations.—The cranium forms a large and deep mesial bony crest

[1] A small part of the spine of the male specimen is broken, but that of the female is entire, and neither appears ever to have been serrated.

before the eyes. The margins of the orbits are cartilaginous, and rise so as to leave a considerable depression between them. The occipital crest is partly bony and is not much elevated. The cavity of the cranium bears a very small proportion to the size of the skull, which is mostly made up of the frontal crest. Two oblong pieces of bone on each side are the only vestiges I could detect of opercula. There are four branchial apertures interiorly, separated by narrow branchial arches which are sparingly furnished with small rakers. There is some bone before the anterior and behind the posterior opening, but most of the branchial apparatus with the rather broad isthmus is cartilaginous, or membranous with some detached ossified spots. Except the first vertebra and parts of the superior spinous processes anterior to the ventrals, the whole spinal column is cartilaginous. It is compressed, flattened beneath, as far back as the middle of the second dorsal, and acute along the ridge from which the spinous processes rise. The interspinous bones of the ventrals of the fore part of the second dorsal, and a few of those of the pectoral are partially ossified. There are no visible interosseous bones to the caudals.

Dimensions.

	Female. In.	Female. Lin.	Male. In.	Male. Lin.
Length from the tip of the snout to point of tail	37	0	31	0
Length from the tip of the snout to under caudal (second)	28	4	0	0
Length from the tip of the snout to upper caudal	28	2	0	0
Length from the tip of the snout to first caudal (under)	26	6	0	0
Length from the tip of the snout to end of second dorsal	26	0	0	0
Length from the tip of the snout to beginning of second dorsal	18	9	0	0
Length from the tip of the snout to base of ventrals, anteriorly	17	6	0	0
Length from the tip of the snout to centre of anus	17	0	0	0
Length from the tip of the snout to beginning of first dorsal	10	0	0	0
Length from the tip of the snout to base of pectorals	7	10	0	0
Length from the tip of the snout to gill-openings	0	0	5	4
Length from the tip of the snout to orbit anterior margin	6	2	4	4
Length from the tip of the snout to frontal appendage (male)	0	0	4	4
Length from the tip of the snout to mouth	0	0	2	7
Longitudinal axis of orbit	1	2	1	2
Length of rostrum about	3	0	2	6
Length of pectorals	7	0	6	0
Length of first dorsal with its membrane	3	6	0	0
Length of second dorsal	7	2	5	2
Length of space between second dorsal and upper caudal	2	2	1	9
Length of upper caudal	8	9	7	4
Length of under caudal	8	4	7	0
Length of first under caudal (anal Müller and Henlé)	1	4	0	10

	Female. In.	Female. Lin.	Male. In.	Male. Lin.
Height of dorsal spine	4	3	0	0
Height of second dorsal anteriorly	2	4	1	6
Height of first under caudal	3	0	2	0
Height of second under caudal anteriorly	2	2	1	6
Length of rostral appendage	1	6	1	4
Breadth of rostral appendage	1	0	0	10

Solander's original description of *Callorhynchus antarcticus* mentions spots, of which there were no traces in our examples of *tasmanius.* It is as follows: "*Piscis non tantummodo maximè singularis sed certissimè pulcherrimus, nitidissimus, argenteus, fulgore cupreo resplendens; maculis magnis ovatis, nigricanti-plumbeis, ad lucem variantibus, in dorso et lateribus adspersis. Nebula transversalis nigra ab occipite ad oculos. Pars carnosa pinnarum pectoralium, supra plumbea, subtus argentea splendidissima.*" *Tasmanius,* when compared with the plates of *antarcticus* above-mentioned, shows a greater space between the dorsal fins, larger ventrals, a less conspicuous upper caudal, a higher under caudal, shorter pectorals, and a difference in the shape of the second dorsal. When compared with Beechey's figure of *C. smythii,* the rostrum appears longer, its obcordate lobe larger and more depending, the dorsal spine seems thicker, not so long, and not serrated, the second dorsal and caudal are differently shaped, and the lateral line is less boldly zig-zagged under the second dorsal.

NARCINE TASMANIENSIS, Tasmanian Narcine.—*Narcine tasmaniensis,* Richardson, Zool. Proceed.

Tab. XI. Fig. 2.

Narcine dorso dipterygio; disco ovato; margine valvulæ nasalis trilobo, integerrimo; pinnâ ventrali disco approximatâ, rotundatâ.

Several specimens of this fish, all females, were included in Mr. Lempriere's collection; but that gentleman says nothing respecting its habits, nor does he mention whether its electrical powers had attracted the attention of the colonists. It differs from the four species of *Narcine* described by Henlé in the ovate form of the pectoral disc, the snout, which is obtuse, forming the narrow extremity of the figure, and the transverse axis of the ovoid posteriorly being greater than its longitudinal one. *N. indica* has a pentagonal disc, the ventrals are not close to the pectorals, and the nasal flap has three acute lobes instead of rounded ones as in *tasmaniensis.* The eyes of *tasmaniensis* are more remote from the spiracles than those of *indica,* and considerably more so than in any of the other described *Narcines. N. timlei* has nearly a circular disc, its pectorals and ventrals are also remote from each other, and its nasal valve is crenated. The disc of *N. brasiliensis* comes nearer to that of *tasmaniensis* in form, but the pectoral fin overlaps the base of the ventrals and the nasal valve has no lateral lobes. *N. capensis* has teeth closely resembling those of *tasmaniensis*, but it has a circular disc, only one back fin, and a more complicated nasal bridle[1].

Description of a female specimen.

Form.—Greatly depressed, the pectoral disc having a broadly ovate outline with the narrow end anteriorly. The widest part of the disc is opposite to the posterior branchial openings, and the breadth there exceeds the length of the disc. The ventrals lying immediately behind the pectoral disc attain to about two-thirds of its breadth. Their outline forms a transverse obtuse oval, with a small blunt lobe on the posterior part of each fin. The tail at its junction to the ventrals has a breadth equal to two-thirds of their disc and tapers gradually to its extremity, which is an acute point in the centre of the caudal fin. Its length is equal to the distance between the anus and the mouth.

The height of the body is one-eighth of its width, the back being flat on the mesial line from the spiracles to the first dorsal fin, but sloping down anteriorly and laterally to the thin edges of the snout and pectorals. The whole under surface is flat, but the tail is convex above, and when it reaches the caudal fin it becomes ancipitous.

The electrical apparatus fill up the lunated spaces between the branchial apertures and pectoral fins, occupying nearly half of the total width of the fish at that part.

The eyes are small and have a lateral aspect, being covered by loose integument proceeding from the mesial sides of the orbits, but they are capable of turning in every direction[2]. The size of the eye is rather greater than that of the common *Torpedo narkè* (or *oculata*). The spiracles have a transversely oval almost circular opening, and are bounded anteriorly by a cartilaginous lip, on which, within the border of the opening, there are eight short, soft, vertical ribs. The distance between the spiracles and eyes is greater than that which exists in any of the *Narcines* described by Henlé, and fully equals what occurs in *Torpedo oculata*. It exceeds the quarter of the space between the eyes.

The nasal valve has three shallow obtuse lobes, and a skinny bridle connects the under surface of the middle one with the loose skin which surrounds the base of the upper jaw. There is also an obtusely lobed fold of integument on the exterior side of each of the two nasal openings.

The mouth is moderately protractile. The teeth are dermal, arranged in quincuncial order, and are individually of a more or less perfect rhomboidal shape, the posterior angle lengthened into an acute spinous process lying in the same plane with the slightly

[1] Since this paper was read Müller and Henlé have established the genus *Astrape* for the reception of *capensis* and *dipterygia*, which have only one back fin. The *Narcine tasmaniensis* departs from the generic characters as laid down by these authors in their 'Beschreibung der Plagiostomen,' in the dentition, the internally ribbed spiracles, the relative size of first dorsal, and some other particulars.

[2] In the figure the artist has shown the eyes when forcibly opened.

uneven but flattish disc of the tooth[1]. The dental surface of each jaw is triangular, the apex of the triangle curving outwards between the labial cartilages over the lip so as to be visible when the mouth is closed. The exterior lips are not greatly developed, but the lining of the mouth is transversely wrinkled, the fold next the dental surface being the largest. The branchial apertures are smooth lunated slits. The vent is situated at the widest part of the ventral disc, and anterior to the middle of the total length of the fish, snout, and caudal fin included.

Dorsal fins ovato-falcate, the first one commencing at the end of the ventrals, and rather exceeding the second one in size. Caudal unequally oval, the lower lobe having a more curved outline than the upper one, and the apex of the ellipsis being above the level of the point of the tail. The height of the fin is rather less than half its length.

The skin is smooth, without the fine reticulations into which the skin of *Torpedo narkè* corrugates in spirits; and its colour is an uniform yellowish-brown, without spots. The under surface is pale.

Anatomical observations.—The skull is wider than that of *Narcine brasiliensis*, particularly between the auditory protuberances and the nasal apophyses, the sides of the skull there being straight, not incurved. The perforation marked *c* in Henlé's figure, t. 7. f. 1. 3., does not exist in the side of the snout cartilage of *Narcine tasmaniensis*, and the anterior cornua of this cartilage are deeply notched, whereas they are entire in *brasiliensis*. The two small triangular cartilages (F. G.) which occupy the space between the snout cartilages and the naso-pectoral processes (*schädel-brust-flossen-knorpel*) in *brasiliensis* are also wanting in *tasmaniensis*, their place being supplied by a fibrous membrane. The jaws of *Narcine tasmaniensis* are much stouter, and have less span than those of *Torpedo narkè*, being stronger in particular at the articulation, where broad processes project from behind the snout in both jaws, whereas these processes are but slightly indicated in *T. narkè*. The lip cartilages of *tasmaniensis* are elliptical and acute, and the upper ones are entire, being without the small notch at the mesial end, which exists in *brasiliensis*. The palatine cartilages are more cylindrical than those of *brasiliensis*. The pectoral girdle is less wide, and is strengthened by broader connecting plates than in *Torpedo narkè*, but the semilunar range of cartilages which supports the pectoral rays is less stout.

The vertebræ are 119 in number; the first, as in *narkè*, very long, with large, broad, triangular, transverse processes. The transverse processes of the two next vertebræ are scarcely evident, but afterwards, up to the fourteenth inclusive, they are uniformly rather short, narrow, and flat. The fifteenth and five following vertebræ send out long slender processes like ribs, four or five times the length of the preceding transverse processes. The twenty-first, twenty-second, and twenty-third have a more lateral ridge,

[1] The surface of a tooth reflects the light in such a way under the microscope, that there is much difficulty in ascertaining its true form. The teeth resemble those of *Astrape capensis*.

which gradually increases in height, and curving downwards towards its fellow forms the commencement of the inferior spinal canal, whose orifice is complete beneath the posterior part of the twenty-fourth vertebra. The succeeding vertebræ are compressed, and their inferior processes are in contact with each other, their truncated tips forming an even, continuous line. Some way behind the second dorsal the spine inclines slightly upwards, and the inferior processes have greater depth for a space, thus producing a curved outline in connection with the attachment of the under lobe of the caudal. The spinous processes form an obscure ridge on the fore part of the spine, but become conspicuous about the sixteenth vertebra. They are very broad and irregular at the fore part of the dorsal fins, become much shorter behind the second dorsal, lengthen at the commencement of the upper caudal lobe, and taper away again towards the point of the tail. Each dorsal is supported by ten rows of little compressed articulated bones. In *Torpedo narkè* the inferior spinal canal is completed at the thirty-fifth vertebra, and the total number of vertebræ in the spinal column is ninety-four or ninety-five, the tail being much shorter than in *Narcine tasmaniensis.* The ventral fins of this fish are supported by twenty-one cartilaginous rays: in *Torpedo narkè* the ventral rays appear to be fewer, and the processes of the pelvic bones are shorter.

The nervous system is in general similar to that of *T. narkè.* The olfactory and optic nerves are conspicuous from their size. The third and fourth pairs are not so readily found. The fifth and electrical nerves are large, and are all composed of bundles of fibres loosely bound together by cellular substance. The fifth issues from the skull considerably behind the optic foramen. It sends some twigs to the muscles of the eye, but its main trunks are distributed to the snout, upon which their twigs form a fine lace-work. Two of these trunks, each as large as the optic nerve, pass over the eye, and one which is still larger passing beneath it runs near the joint of the naso-pectoral cartilage. The electrical nerves may be divided by the way in which they issue from the skull into two or three sets. 1st. Two trunks issue in contact with each other immediately before the quadrate bone, the anterior and smaller of which running forwards over the joint of the naso-pectoral cartilage, passes near the last-mentioned trunk of the fifth nerve, and then keeping along the upper edge of the semilunar arch of the pectoral cartilages on the outside of the electrical apparatus, supplies the upper surface of the pectoral fin. The second trunk goes directly to the fore part of the electrical apparatus. 2nd. Three large trunks issue from beneath the auditory protuberance behind the quadrate bone, and pass between the several pairs of gills to the electrical apparatus. 3rd. A nerve coming from the skull almost in contact with the posterior trunk of the seeond bundle sends twigs to the posterior gills, and then passing backwards beneath the transverse process of the first vertebra, and through the pectoral girdle, traverses a canal in that girdle, and is distributed to the upper surface of the pectoral fin, completing, in conjunction with the anterior trunk of the first bundle of electrical nerves, a nervous circuit round the outer margin of the electrical apparatus. In *Torpedo narkè* the third electrical nerve issues more superiorly, and crosses the root of the third trunk of the second bundle in its course backwards. In both fish the third nerve appeared to send a large branch backwards through the pectoral girdle to the viscera or tail, but the specimens examined did not admit of my correctly ascertaining the origin of this branch. In *Narcine tasmaniensis* many nerves issue from foramina in the long first vertebra, and immediately join to form a trunk which runs backwards over the wing-like transverse process, turns round the edge of the broad lateral plate of the pectoral girdle, and keeping along the postero-superior margin of the girdle enters a canal in the outer limb of that cartilage, where it divides into branches going to both surfaces of the pectoral fin. In *Torpedo narkè* these spinal nerves do not form a longitudinal trunk above the lateral process, but run separately outwards over the surface of that bone, converging like the sticks of a fan towards a canal in the pectoral girdle, after leaving which they are principally distributed on the under surface of the pectoral. The stomach of the specimen of *N. tasmaniensis* which was examined, contains tender crustacea.

Dimensions.

	In.	Lin.
Length from extremity of snout to tip of caudal fin	14	3½
Length from extremity of snout to end of tail	13	6
Length from extremity of snout to end of second dorsal	10	11
Length from extremity of snout to beginning of second dorsal	9	11
Length from extremity of snout to end of first dorsal	9	0
Length from extremity of snout to beginning of first dorsal	8	11
Length from extremity of snout to end of ventrals	7	9½
Length from extremity of snout to vent	6	3
Length from extremity of snout to end of pectorals	5	6
Length from extremity of snout to spiracles	1	9
Length from extremity of snout to eyes	1	2
Length from extremity of snout to mouth	1	7
Length from extremity of snout to nasal openings	1	1
Length from extremity of snout to last branchial opening	3	7
Length from extremity of snout to first branchial opening	2	2
Height of back	0	9
Height of tail behind ventrals	0	8½
Width of body and pectorals	6	1
Width of body a little further forward, excluding pectorals	4	3
Width of body and ventrals	4	2
Width of tail posterior to ventrals	1	5
Width of tail at origin of caudal fin	0	3
Distance between the spiracles, or between the eyes	0	3½

	In.	Lin.
Height of first dorsal	1	3
Height of second dorsal	1	2
Height of caudal	1	0
Length of caudal	2	6
Projection of caudal beyond tip of tail	0	$8\frac{1}{2}$

Syngnathus argus (Nob.), Ocellated Pipe-fish.—*Syngnathus argus*, Richardson, Zool. Proceed., March 10, 1840.

Tab. VII. Fig. 2.

Syngn. depressus, latus, pinnis pectoralibus pinnâque dorsi præditus, ventralibus caudalique orbatus; dorso maculis oculeis ornato; in margine ventris maculis albis unâ serie dispositis.

In the 'Règne Animal' Cuvier groups the pipe-fish by the number of fins which they possess, but he mentions none which are like this species destitute of caudal and ventrals, and at the same time furnished with pectorals and a dorsal. In the depressed form of the body the *Syngnathus argus* resembles the *S. perlatus* of Beechey's Zoological Appendix, but that species has a caudal fin.

Form.—Four-sided, the body depressed, the belly convex, between three and four times wider than the narrow back, the sides consequently sloping to unite the two. The body gradually widens from the pectorals to the dorsal (where the width is twice the height), and then as gradually contracts again until it passes that fin some way, the form changing insensibly into that of a tapering equilateral, rectangular tail, which ends in a point. The whole length contains six and a half lengths of the head, and the anus is rather before the middle of that length. Other proportions may be learnt from the table of dimensions.

The hair-brown back and sides are studded in a very beautiful manner with oval black spots having white borders, about twenty on each segment, and at the acute union of the side with the belly there is one oblong milk-white spot on each segment. The belly is pale and unspotted.

There are sixty-eight segments in all, including the minute tip of the tail, which under the microscope appears to be slightly notched. Twenty segments or plates may be counted on the belly before the anus, and there are forty-eight behind including the one which contains the aperture. There are eleven anterior to the dorsal, which extends over eighteen more and a part of the nineteenth, behind which there are thirty-eight: so that the dorsal extends eight segments beyond the anus.

Rays.—D. 48; P. 15; the first one short.

The pectorals are small and have a rounded outline. The two or three first rays of the dorsal are a little shorter than the succeeding ones, which continue nearly of one length to the posterior quarter of the fin, when they gradually but slightly decrease in height.

DIMENSIONS.

	In.	Lin.
Length from mouth to tip of tail	7	9
Length from mouth to end of dorsal	4	5
Length from mouth to anus	3	7
Length from mouth to beginning of dorsal	2	7½
Length from mouth to pectorals	1	3½
Length from mouth to gill-openings	1	2¼
Length from mouth to centre of eye	0	8½
Length of dorsal	1	9
Breadth of body at fore-part of dorsal	0	4½
Height there	0	2

EXPLANATION OF THE PLATES (Part 2.).

PLATE VII.

Fig. 1. HOPLEGNATHUS CONWAYII, (Rich.), one third of the natural size.

1 *a*. Side view of the jaws, natural size.

1 *b*. Front view of ditto ditto.

Fig. 2. SYNGNATHUS ARGUS (Rich.), natural size.

2 *a*. Vertical section of ditto.

PLATE VIII.

Fig. 1. LEPIDOLEPRUS AUSTRALIS (Rich.), half the natural size.

1 *b*. Vertical section of ditto.

1 *e*. Scale from the cheek of ditto, magnified.

1 *d*. Scale from the lateral line of ditto, magnified.

Fig. 2 *a*. Scale from the head of LEPIDOLEPRUS CŒLORRHYNCHUS (taken from Mr. Lowe's Madeira specimen in the Zoological Society's Museum), magnified.

2 *b*. Scale from the lateral line of the same specimen.

Fig. 3. Scale from the body of LEPIDOLEPRUS TRACHYRHYNCHUS (taken from a dried specimen in the Zoological Society's Museum), magnified.

PLATE IX.

Fig. 1. (young), Fig. 2. (old). OSTRACION AURITUS (Shaw), natural size.

1 *a*. Vertical section of young specimen.

1 *b*. Ditto of old.

PLATE X.

Fig. 1. Ostracion spilogaster (Rich.), natural size.

1 *a*. Vertical section of ditto.

Fig. 2. Ostracion ornatus (Gray), natural size.

2 *a*. Vertical section of ditto.

PLATE XI.

Fig. 1. Ostracion flavigaster (Gray), natural size.

1 *a*. Vertical section of ditto.

Fig. 2. Narcine tasmaniensis (Rich.), half the natural size.

2 *a*. Under surface of ditto.

2 *b*. Dental plate of under jaw, enlarged.

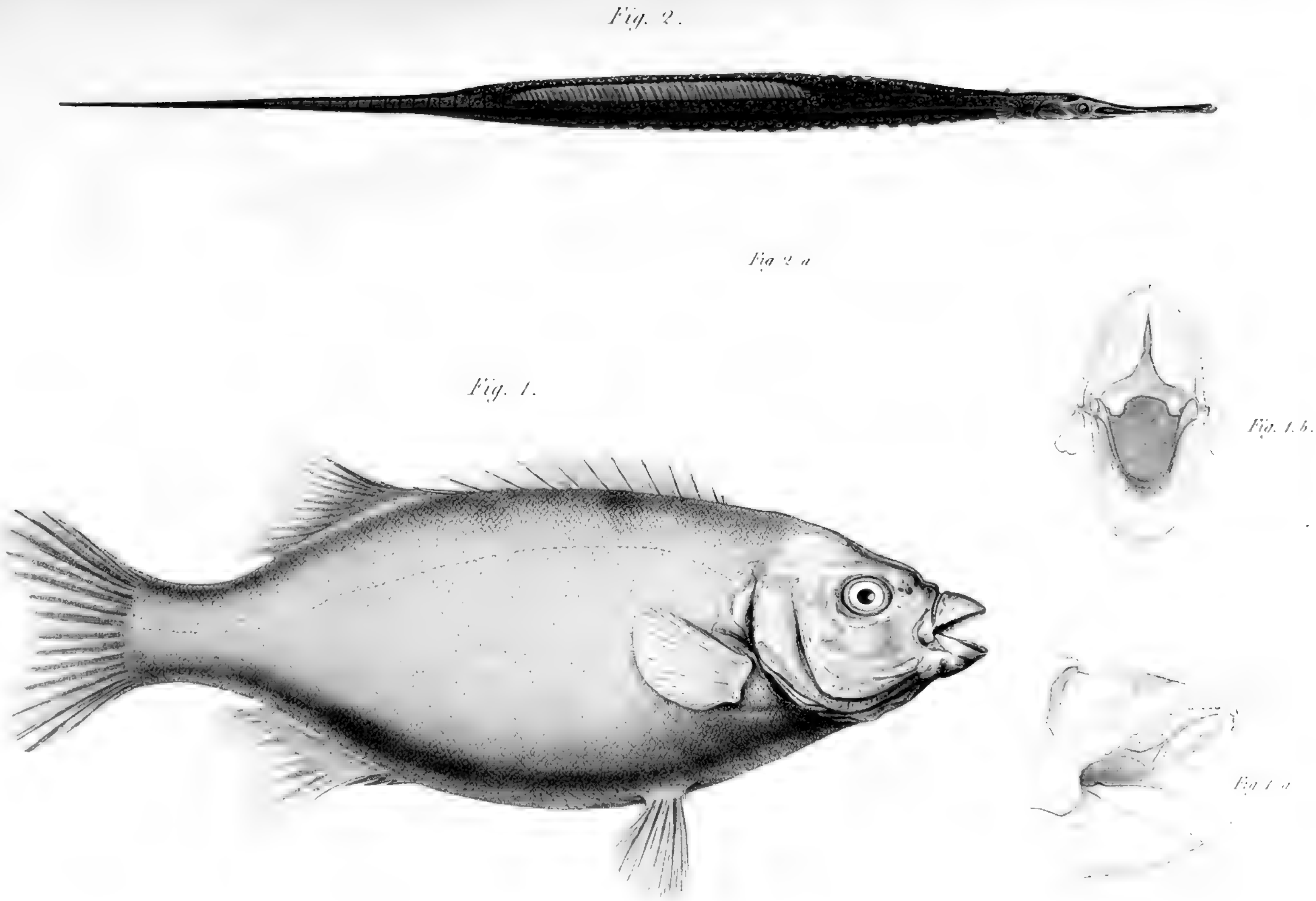


Fig. 1. Hoplegnathus Conwayii. (Rich.) p. 145. $\frac{2}{3}$ nat. size
2. Syngnathus Argus (Rich.) p. 182. nat. size

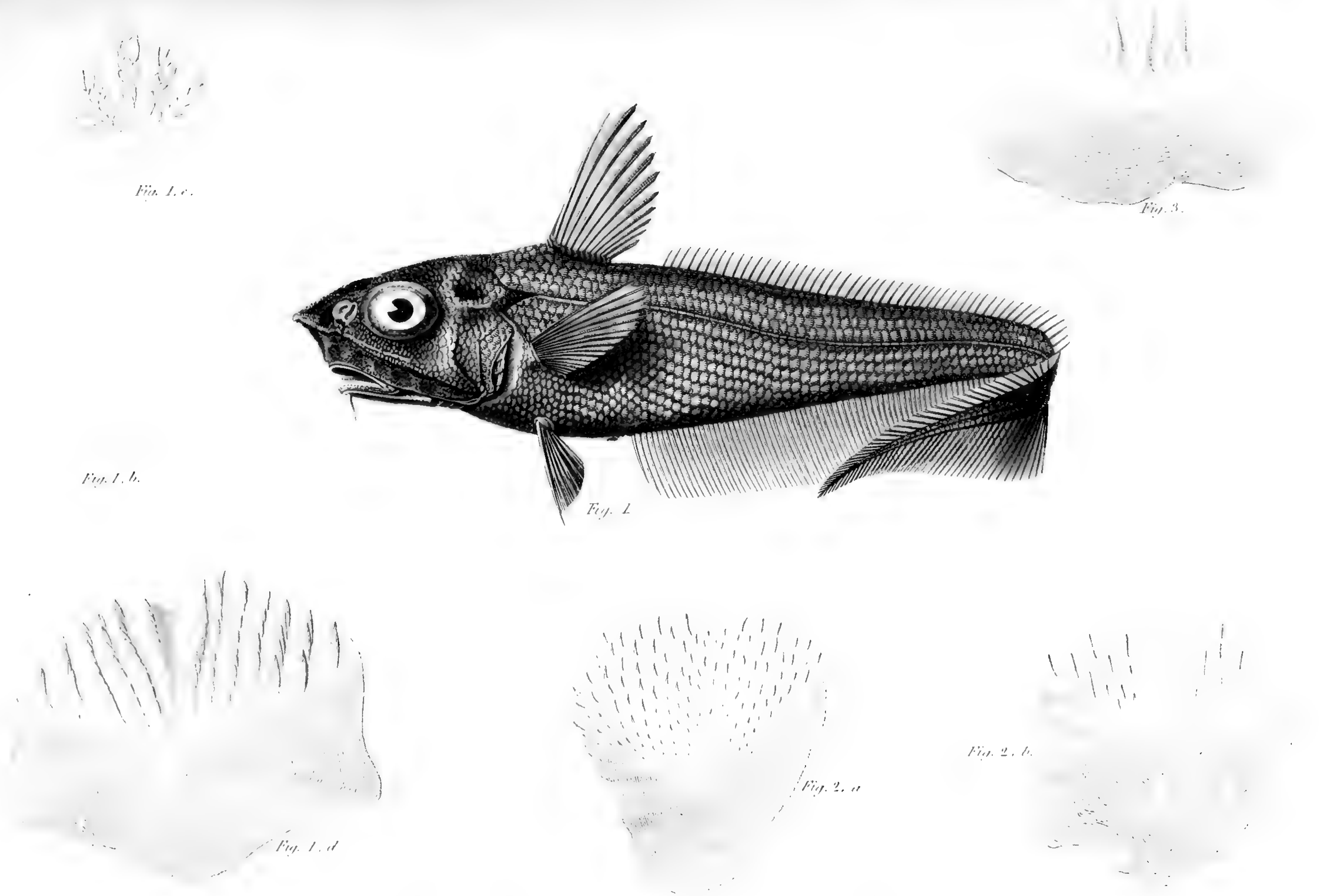


Fig. 1. Lepidolepris australis (Rich) p. 151, half the nat. size.

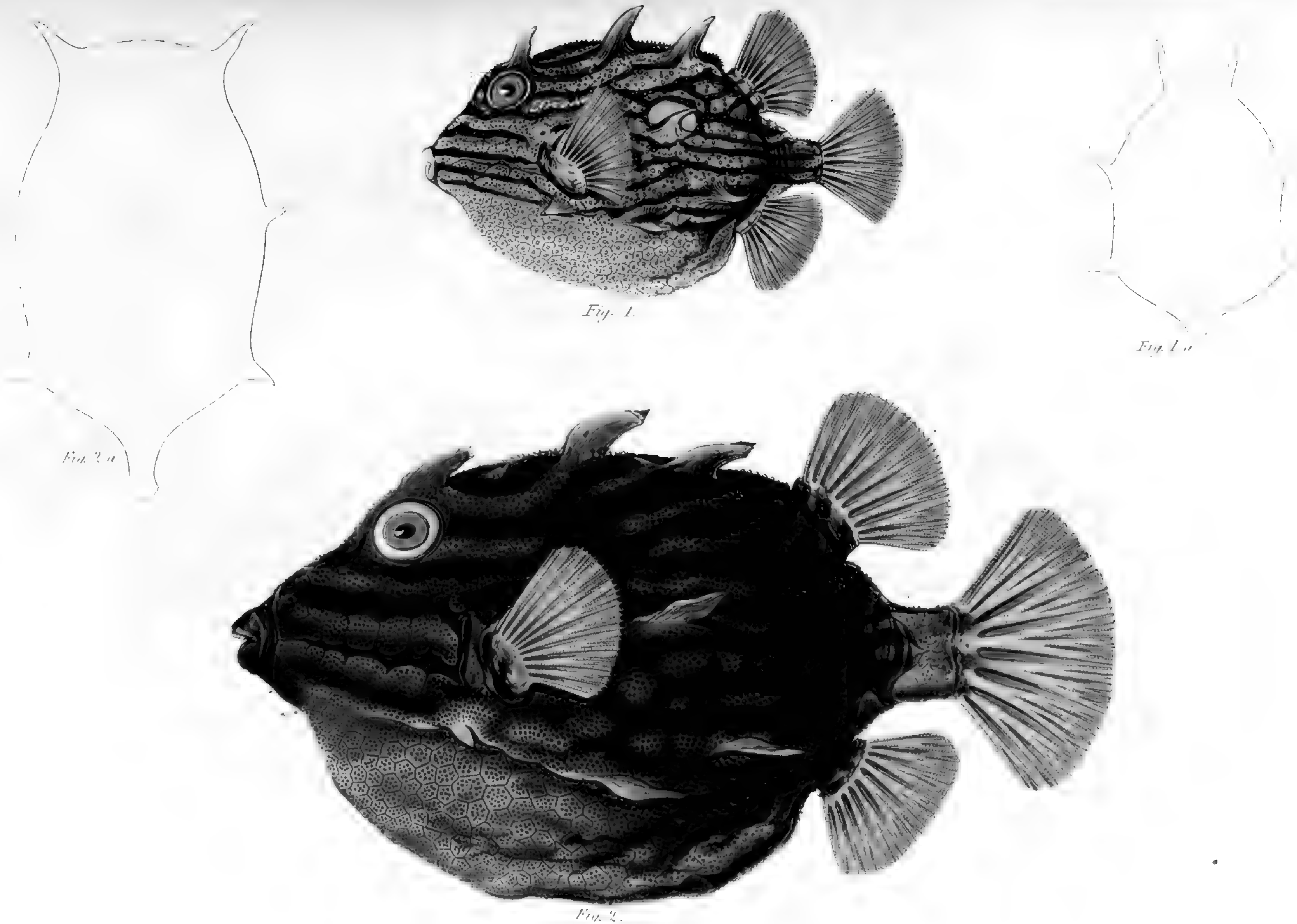


Fig. 1 and 2. Ostracion [illegible] Mus. Brit. nat. size.

Fig. 2.

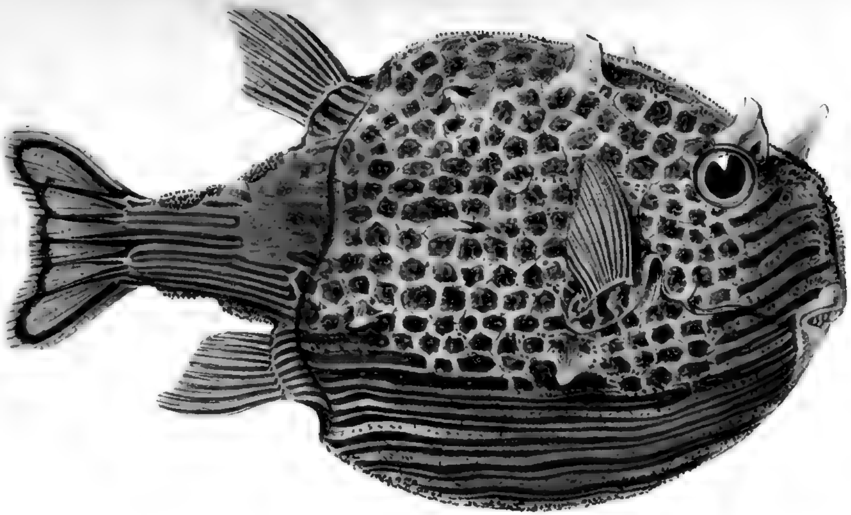


Fig. 2. a

Fig. 1.

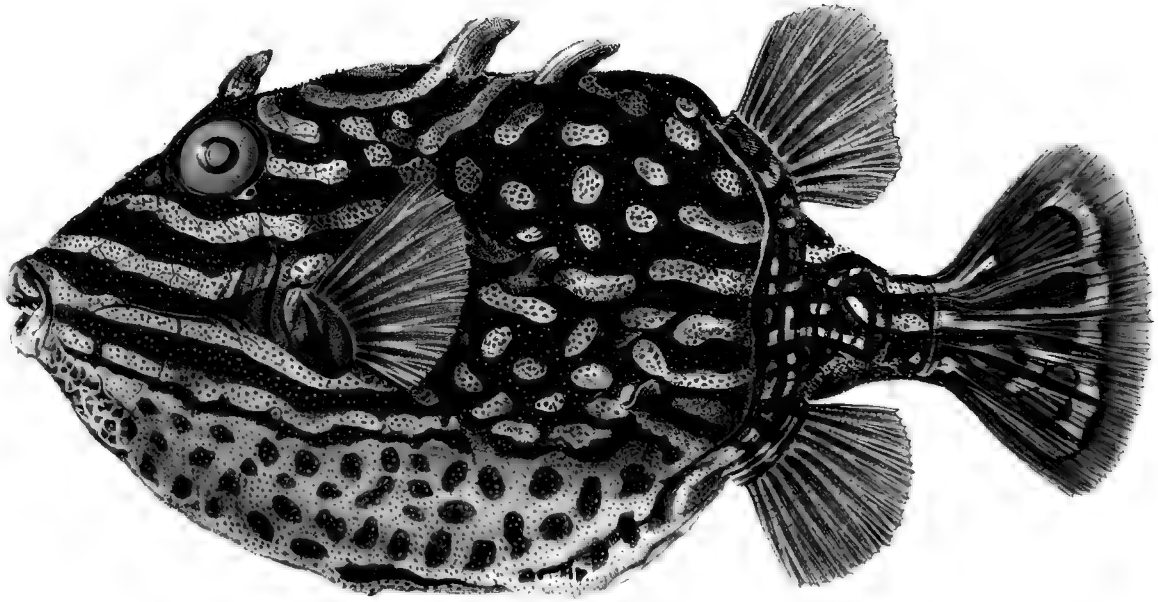


Fig. 1. a

W. Hawkins & W. Mitchell del.

Fig. 1. *Ostracion spilogaster.* (Rich.) p. 163. nat. size.
2. *ornatus.* (Gray) p. 165. nat. size.

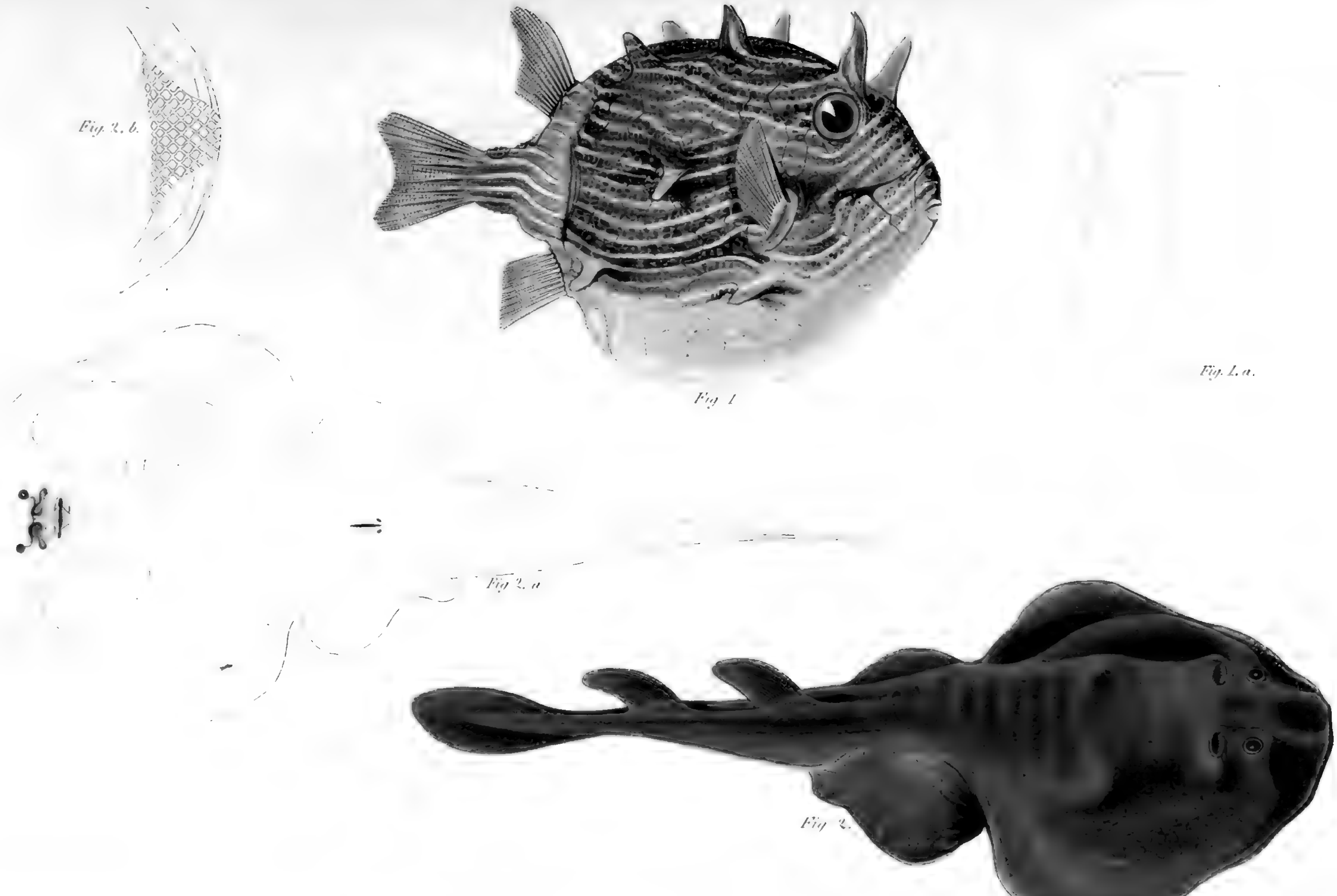


Fig. 1. Ostracion flavigaster (Gray) p. 164. nat. size   Fig. 2. Narcine tasmaniensis, Rich. p. 178.

VI. *Observations on the* Stenochoridæ *of New Holland, with Descriptions of New Genera and Species of that Family. By the Rev.* F. W. Hope, *A.M., F.R.S., F.L.S. &c.*

Communicated June 23, 1840.

In the month of May, in the year 1833, I submitted to the Zoological Society a Memoir, containing descriptions of several new genera of Coleopterous insects, which was shortly afterwards published in the first volume of the Transactions of the Society[1].

Nearly at the end of the paper I gave a synoptical Table of the genera known at that period belonging to the *Stenochoridæ*, dividing them into two sections. Since that publication, Monsieur Audinet Serville of Paris has published his remarks on the Longicorn beetles generally; and what is singular, has altogether omitted the genus *Stenochorus*, substituting in its place the name of *Mallocera*. Really, if we are to allow the Linnæan and Fabrician names to be expunged at the caprice of any individual or individuals whomsoever, and others to be introduced in their stead, there will be no end of confusion. The orismology of entomology is already too burdensome to allow of any unnecessary additions; and that I have not advanced an opinion which can be doubted, I will only allude to a work, one which may be considered as exhibiting the opinions of a large portion of the entomologists of France—I mean the new edition of the Catalogue of the Baron Dejean. In that work the genus *Stenochorus*, which was published by Fabricius many years back, is abandoned, whilst the Servillean *Mallocera* is substituted in its place. Had this been the only Fabrician genus discarded, I should probably have only slightly alluded to it; but when I find other Longicorn genera, such as *Lamia* and *Cerambyx*, are not admitted, and that to these may be added the expulsion of *Buprestis, Elater, Cnodulon, Tritoma, Haltica*, &c., it would be neglect on my part did I not endeavour

[1] I purposely give the date of the publication alluded to, and it is taken from the 8vo volume of the Proceedings of the Zoological Society of London. I subjoin also an extract from Monsieur Guérin's Magazine of Zoology (vide Vol. 6^me^ Année): "Mon *Amallopodes scabrosus* (Mag. de Zool. cit.) a été décrit par M. Hope sous le nom de *Prionus Cumingii* (voy. Trans. de la Soc. Zool. de Lond., vol. i. part 2. page 105, pl. 14, fig. 7). M. Hope ajoute qu'on pourrait établir avec cette espèce un sous-genre sous le nom de *Acanthinodera*. Ma publication est du mois de Novembre 1833. Le mémoire de Mr. Hope a été communiqué le 28 Mai 1833, mais n'a été publié qu'en 1834." In answer to the above passage I have only to remark, that Monsieur Guérin alludes to the publication of the quarto Transactions of this Society, and seems to be totally unacquainted that the Proceedings are previously published in 8vo. In the volume of 1833, at page 61, the date of the paper in question is May the 28th, consequently M. Guérin's claim of priority falls to the ground. The name of Cuming, therefore, ought to be adopted. It is remarkable that the above insect was also called *Prionus Mercurius* by Dr. Frederick Eschscholtz; the date of the latter was however in 1834.

to put a stop to an evil which can only have the effect of retarding science. Sorry am I to add, that one of our English naturalists follows in the same foreign wake, and it is singular that the same individual agrees in expunging *Stenochorus*, and yet introduces the novel term of *Phoracantha*. Now it is my fixed opinion that both *Mallocera* and *Phoracantha* ought to be rejected and the original word substituted. Having decided, on sufficiently ample grounds, that *Stenochorus* should be retained, it remains for me to add the reasons why *Stenochorus* ought to be admitted to rank as a family. It is remarkable, that out of eleven Longicorn genera mentioned by Fabricius, eight of them must be regarded as evidently belonging to distinct families. The genus *Calopus* of the same author belongs properly to the *Stenelytra*, and ought not to be included; the remaining two, namely *Gnoma* and *Clytus*, are worthy of a similar rank, the former affording several forms which are yet unpublished; and the latter may well be subdivided into the sections proposed by the Count de Castelnau, and might have generic names appropriated to them. It will then appear, from the above brief statement, that all of the genera of Longicorn beetles constituted by Fabricius are thought worthy of ranking as families, with the exception of *Calopus*, which is evidently out of place: but there are other grounds for retaining *Stenochorus*; first, some of the ablest entomologists who have ever written on entomology are in favour of the genus. It is sufficient for our present purpose to mention but a few, and I therefore merely give the names of Fabricius, Olivier, MacLeay and Schönherr; the latter writer, indeed, appears to be the first individual who considered *Stenochorus* in the light of a group, forming three distinct families; the first being named *Cerambyciformes*, the second *Callidiiformes*, whilst the last embraces genera of diverse forms. It has been stated, however, by one who wishes to get rid of *Stenochorus*, that *Rhagium* is synonymous with it; he gives, nevertheless, the true type of the genus, and names it *semipunctatus* of Donovan, an insect originally described by Fabricius or Olivier. The writer probably was not aware that Knoch, in his 'Neue Beyträge zur Insectenkunde,' published at Leipsig in 1801, has published some valuable remarks on the *Stenochorus cyaneus*, Fab., with anatomical dissertations, distinctly naming the same a *Rhagium*. Now the above work bears the same date as the 'Systema Eleutheratorum' of Fabricius; and as able writers since that period, coinciding with Knoch, have adopted his views, the question ought not to be raised again.

The original type being disposed of, it was necessary to fix on another. Monsieur Schönherr chose *Stenochorus festivus*, Fab.; Mr. W. S. MacLeay, Boisduval and others consider *Stenochorus semipunctatus* of Fabricius as the true type; and Mr. Newman (it may be added) also records the same typical species, although he abandons the Fabrician and Servillean names, and substitutes in their place the term of *Phoracantha*. On the ground of priority the name of Fabricius ought to be retained; and if that is rejected, certainly *Mallocera* ought to take precedence of *Phoracantha*.

Having fixed on the typical species, it is now my intention to describe more fully some of the *Stenochoridæ* formerly published in these Transactions; and as the species in my collection of this family are very considerably increased in number, I shall confine my remarks chiefly to those which are from New Holland. It is satisfactory to state previously, that of the twelve genera proposed, and a thirteenth suggested by me as a subgenus, in the memoirs of 1833, the major part of them are now adopted as genera, although they bear different generic names. The following tables will perhaps give the reader a more concise view of the points of agreement and difference than anything I can state.

Hope's Genera and Types in 1833.	Serville's Genera and Types in 1834.
Section I.	
1. *Stenochorus, Sten. semipunctatus*, Fab.	*Mallocera, Sten. glauca*, Dejean.
2. *Acanthinomonus, Sten. spinicornis*, Fab.	*Cordylomera, Sten. spinicornis*, Fab.
3. *Cycliopleurus, Sten. irroratus*, Fab.	*Elaphidion, Sten. irroratus*, Fab.
4. { "Genus nondum detectum."	
{ *Monacantha*[1], Kirby; *Surinama*, Fab.	*Achryson Serville? Sten. pallens*, Fab.
5. *Tmesisternus*[2], Latr.; *biguttatus*, Don.	*Tmesisternus, Cal. variegatus*, Fab.
Section II.	
6. *Tetracanthus, Sten. festivus*[3], Fab.	*Chlorida, Sten. costata*, Dejean.
7. *Dissacanthus, Sten.* 4-*maculatus*, Fab.	*Eburia, Sten.* 4-*maculatus*, Fab.
8. *Uracanthus*[4] *triangularis.*	*Uracanthus triangularis.*

The remaining four genera of *Scolecobrotus*, *Strongylurus*, *Coptopterus* and *Piesarthrius* are all from New Holland, and were unique in my cabinet at the time I proposed them, and I believe are still unknown to foreign entomologists. It must also be added that *Stenochorus rufipes* of Klug, which was suggested to be formed into a subgenus, has since received the appellation of *Stenosphenus* by the Baron Dejean. I am not aware, however, if its generic characters are given. It will appear then, from a view of the above tables, that out of the thirteen genera proposed seven are adopted by M. Serville and two by Dejean, some of them having the self-same types, whilst the remaining four are peculiar to New Holland, and if not unique in my collection at present, are most likely unknown to French writers. But it is time to proceed to the descriptions of the *Stenochoridæ* of New Holland, including the four genera mentioned above.

[1] I have reasons to think that *Monacantha Surinama* of Kirby, and *Achryson pallens* of Fabricius, are the same insect.

[2] The typical species of *Tmesisternus* seems doubtful; from examining *Sten. biguttatus* of Donovan, it appears to belong to the genus *Coptocercus mihi.*

[3] *Festivus* of Fabricius and *costata* of Dejean belong evidently to the same genus.

[4] *Uracanthus triangularis*, Hope, is the *angustatus* of Dejean and the *elongatus* of Gory.

Fam. Stenochoridæ, Leach.

Sect. 1. *Armigeri.*

Antennis thoraceque spinosis; apicibus elytrorum bidentatis.

Genus Stenochorus[1], Fab.

Stenochorus gigas.

Tab. XII. Fig. 5.

Sten. ater, thorace spinoso inæquali, elytris ad basin nigro flavoque variegatis.

Descr.—*Antennæ* corpore fere duplo longiores, articulis ternis primis nigricantibus, reliquis fusco-ferrugineis, articulis intermediis apice spinosis. *Caput* atrum antice rufo-ciliatum, palpis ferrugineis. *Thorax* utrinque spinosus, spinis brevibus, tuberculatus, rugosus et ater. *Elytra* bidentata, ad basin nigro flavoque variegata, varioloso-punctata. *Corpus* infra nigrum abdomine postice piceo, femoribus atris, tibiis tarsisque fusco-brunneis et tomentosis.

Long. lin. 18½; lat. lin. 5½.

Hab. In interiori parte Novæ Hollandiæ.

In Museo Dom. Hope.

This magnificent species, the largest of the genus, was given to Captain Roe, when engaged on his survey of the Australian coast; it was labelled as coming from the inner country.

Stenochorus latus.

Sten. fusco-brunneus, thorace cinereo-tomentoso, elytris flavo brunneoque variegatis.

Descr.—*Caput* cinereum. *Antennæ* longitudini corporis vix æquales. *Thorax* utrinque spinosus, spinis acutis, tomentosus et rugosus, antice binis tuberculis rubro-piceis insignitus. *Elytra* flavo brunnea maculisque nigris variegata, macula suturali magna lunulata, ad apicem posita. *Corpus* infra nigrum, pectore, pedibusque brunneo-piceis, tarsisque auricomatis.

Long. lin. 15; lat. lin. 4.

Hab. In Nova Hollandia circa Flumen Cygnorum.

In Mus. Dom. Hope.

Stenochorus longipennis.

Sten. atro-brunneus, thorace cinereo, elytris antice flavo variegatis, postice piceo-brunneis.

Descr.—*Antennæ* longitudine corporis, fusco-flavæ et tomentosæ. *Thorax* utrinque spinosus, spinis acutis, ad humeros elytrorum curvatus, rugosus, tuberculo nigro et glabro in medio disci posito. *Elytra* elongata ad apicem parum attenuata, antice brunnea, lineis flavis longitudinalibus variegata, postice reliqua parte disci atro-

[1] Type of the genus *Stenochorus semipunctatus*, Fab.

brunnea. *Corpus* infra fusco-brunneum, femoribus tibiis pallidioribus et tomentosis, tarsisque auricomatis.

Long. lin. 13; lat. lin. $3\frac{1}{2}$.

Hab. Van Diemen's Land.

STENOCHORUS MITCHELLI.

Tab. XII. Fig. 8.

Sten. straminicolor, capite nigro, antennis flavis, thorace atro-cinereo, elytrisque flavo brunneoque variegatis.

DESCR.—*Caput* atrum. Thorax bispinosus, spinis utrinque minutis, disco rugoso, atro-cinereo. *Elytra* pallide flava sutura maculisque brunneis variegata. *Corpus* infra rubro-brunneum annulis abdominis aurato-tomentosis, femoribus et tibiis concoloribus tarsisque aurato-spongiosis.

Long. lin. 12; lat. lin. $3\frac{1}{4}$.

Hab. In Nova Hollandia.

This singularly marked insect I have named in honour of Sir T. Livingston Mitchell, the author of one of the most interesting works which has yet appeared respecting Australia.

STENOCHORUS TRIMACULATUS.

Tab. XII. Fig. 9.

Sten. pallide flavus, antennis pedibusque luteis, thorace cinereo elytrisque nigro maculatis.

DESCR.—*Caput* piceo-brunneum. *Antennis* flavis sparsimque tomentosis. *Thorax* utrinque spinosus, spinis brevibus, rugoso-tuberculatus et argenteo-cinereus, scutellum flavum. *Elytra* ad basin nigra, macula magna ovali pallide flava ante apicem in singulo posita. *Corpus* infra rubro-fuscum et argenteo-tomentosum. *Pedes* lutei.

This elegant species I received from Captain Roe; it was captured at the Swan River settlement.

STENOCHORUS OBSCURUS, Donovan.

Sten. thorace rugoso, spinoso, fuscus, elytris antice punctato-rugosis, postice lævibus nitidis apice bidentatis.

Long. lin. 11; lat. lin. 3.

This species appears to be of rare occurrence. I have seen only three specimens; all of them were from Van Diemen's Land.

STENOCHORUS PUNCTATUS, Donovan.

Sten. thorace spinoso, fuscus, elytris punctatis antice subrugosis, apice bidentatis maculis tribus flavis.

Long. lin. 11; lat. lin. $2\frac{1}{2}$.

This species I obtained at the sale of the late Mr. Donovan's insects; it was labelled as received from Van Diemen's Land. The colour of this species in Donovan's plate is not dark enough; the variety with the basal and median spots united on the elytra is by no means uncommon; the species is also liable to vary considerably in size; a small specimen measured only $8\frac{1}{2}$ lines long and 2 in width.

STENOCHORUS SEMIPUNCTATUS, Fabricius.

Sten. thorace spinoso, fuscus, elytris antice punctato-rugosis, flavo-fasciatis, postice lævibus, apice bidentatis macula flava. Vid. Oliv. 4—67. p. 37, 48; Stenoch. 69. tab. 2. f. 19; Enc. Méth. 5. p. 303, 56; Schönherr, Syn. Ins. vol. i. part 3. page 404. species 9.

Long. lin. 11; lat. lin. 3.

The localities of 'Brasilia' and 'Nova Hollandia' are mentioned by the latter author; there cannot exist a doubt that the former locality is erroneous. The species is subject to great variation. I mention some of the most particular.

Var. α. *Elytris in medio trimaculatis, maculis binis anticis parvis, postica triplo majori.* (Long. lin. 8; lat. lin. $1\frac{3}{4}$.)

Var. β. *Elytris late flavo-fasciatis maculis nigris aspersis.* (Long. lin. 7; lat. lin. $1\frac{1}{2}$.)

Var. γ. *Elytris late flavo-fasciatis, nigris, binis maculis notatis, apice late flavo, spinisque concoloribus, antennis pedibusque pallidis.* (Long. lin. 11; lat. lin. 3.)

This is probably an immature specimen.

STENOCHORUS ANGUSTATUS, Dejean.

Sten. valde elongatus, parallelus, pubescens, fusco-cinereus, thorace subplicato, conico, lineis duabus albidis; elytris macula laterali antica, elongata, fusca.

Long. lin. 10; tot. 15.

In Museo MM. Dejean et Gory.

The above description is taken from the 'Voyage de l'Astrolabe,' by Mons. Boisduval; vide part 2. p. 475.

STENOCHORUS UNDULATUS.

Sten. nigro-brunneus, antennis aurato-tomentosis, thorace supra tuberculato et concolori, medio disci macula elevata rubro-picea et polita.

DESCR.—*Scutellum* aureo-tomentosum. *Elytra* fusco-brunnea, fasciis binis mediis undulatis pallide flavis apicibus concoloribus. *Corpus* infra rubro-piceum, pedibus aureo-tomentosis.

Long. lin. 10; lat. lin. $2\frac{1}{2}$.

This species inhabits New Holland, and was sent me by Captain Roe from the new English settlement at the Swan River in Australia. I must remark, that in this species the spines at the apex of the elytra appear unusually short, those at the suture are scarcely perceptible. I imagine therefore, as the insect is unique and much damaged, that probably they have been broken off.

STENOCHORUS ASSIMILIS.

Sten. rufo-brunneus, antennis concoloribus et tomentosis.

DESCR.—Affinis præcedenti. *Thorax* rufo-piceus, supra tuberculatus tuberculis quinque elevatis majoribus ita dispositis :|: reliquis minoribus. *Elytra* rufo-brunnea, fascia elongata irregulari undulata et flava, apicibus flavo-maculatis. *Corpus* infra rufum, femoribus et tibiis concoloribus et subtomentosis tarsisque auricomatis.

Long. lin. 10½; lat. lin. 2½.

I received this insect from Van Diemen's Land.

STENOCHORUS ACANTHOCERUS, MacLeay.

Sten. fusco-ferrugineus capite punctato; antennis rubris, articulo 3^{tio}, 4to, 5to *et* 6to *apice spinosis; ore rubro; maxillis elongatis, apice ciliatis membranaceis; palpis securiformibus; thorace obscuro utrinque unispinoso margine antico tuberculisque dorsalibus utrinque posticoque semicirculari rubris; scutello rubro; elytris rubris fasciis tribus nigris undatis, ad basin inter lineas elevatas subcrenatis, apicemque versus punctatis, apice bidentatis; corpore subtus nigro nitido tomentoso; pedibus rubris.*

In Mus. Dom. MacLeay.

STENOCHORUS DORSALIS, MacLeay.

Sten. fulvo-piceus, capite angusto, labro palpisque testaceis, vertice canaliculato; thorace inæqualiter rugoso, eminentia media ovali glabra tribusque aliis utrinque vix conspicuis; elytris bidentatis subelevatis interstitiisque punctatis, macula media suturali testacea antice subemarginata; antennis subtus villosis, articulis apice haud spinosis; corpore pedibusque piceis; femoribus incrassatis.

In Mus. Dom. MacLeay.

Hab. In Nova Hollandia.

Section 2. *Tubericolles.*

Antennis spinosis, thorace tuberculato, haud spinoso, apicibus elytrorum bidentatis femoribusque incrassatis.

STENOCHORUS UNIGUTTATUS, MacLeay.

Tab. XII. Fig. 7.

Sten. fuscus, capite cum antennis villosis, thorace inæquali rugoso, tuberculato; elytris depressis crebrissime punctulatis, in singulo macula quadrato-elongata et lutea, fere in medio disci posita.

DESCR.—*Corpus* infra rubro-fuscum tomentosum, femoribus incrassatis et concoloribus, tarsis infra flavo-spongiosis.

This species I received from the Swan River: it is subject to great variation in size.

A specimen similar to Mr. MacLeay's *uniguttatus* measures in length, lin. 10½; lat. lin. 2. It seems likely that *Sten. elongatus* of Dejean is the same as the above species.

Stenochorus rhombifer.

Sten. fuscus, antennis et corpore sparsim flavo-tomentosis, capite haud villoso, rubro.

Descr.—Affinis præcedenti at multo minor. *Thorax* inæqualis et tuberculatus. *Elytra* depressa bidentata, macula quadrato-elongata lutea fere in medio disci posita. *Corpus* infra rubro-piceum nitidum, binis ultimis segmentis pallidioribus. *Pedes* rubro-fusci femoribus parum incrassatis tarsisque infra aureo-tomentosis.

Long. lin. 7; lat. lin. 1¼.

In Mus. Dom. Hope.

I received this species in a box of insects from Mr. Charles Darwin. Its true locality is either Sydney or Van Diemen's Land.

I consider it quite distinct from Mr. W. Sharpe MacLeay's *Stenochorus uniguttatus.*

Stenochorus tunicatus, MacLeay.

Sten. flavus; antennarum articulis duobus primis nigris, quinto apice, septimo nonoque nigris; thorace subcylindrico utrinque unidentato, supra quadri-tuberculato, tuberculis anticis majoribus; elytris apice flavis, unidentatis, parte basali ultra medium subviolaceo-flava, linea obliqua terminata; corpore pedibusque flavo-testaceis.

In Mus. Dom. MacLeay.

Stenochorus rubripes, Boisduval.

Tab. XII. Fig. 4.

Sten. elongatus parallelus; antennis pedibusque rufis; thorace angustiori, cylindrico, tuberculato; elytris dilute fuscis, apice spinosis, punctis crebris impressis, macula communi maxima irregulari, nigra notata, altera postica, scutelloque flavis.

Long. lin. 10½; lat. lin. 2½.

Described from Mons. Boisduval's 'Voyage de l'Astrolabe,' vid. part ii. page 479. I had given the name of *undulatus* to the species, and had figured it before I was aware of its being described: the sexes apparently differ considerably in size.

Stenochorus Roei.

Sten. rubro-fuscus; antennis pallidioribus; thorace tuberculato, elytrisque macula irregulari flava notatis, alteraque apicali lutea, spinis apice brevibus, externo longiori.

Descr.—*Corpus* infra rubro-piceum nitidum, pedibus concoloribus et tomentosis.

Long. lin. 6¼; lat. lin. 1¼.

This species was sent to me from the Swan River by Captain Roe; it is named after that indefatigable and enterprising officer.

Section 3. *Fissipennes.*

Antennæ spinosæ, thorace inæquali tuberculato seu denticulato, apicibus elytrorum transverse truncatis, haud spinosis.

Gen. Coptocercus[1], Hope, nov. gen.

Caput antice rugosum, antennis spinoso-tomentosis. *Thorax* fere cylindricus, tuberculatus. *Elytra* parallela thorace latiora, ad apicem parum contracta, transverse fissa, haud spinosa. *Corpus* infra convexum, antennis pedibusque fere ut in *Sten. Roei* conformatis.

Type of the Genus, *Stenochorus biguttatus* of Donovan.

Coptocercus biguttatus, Donovan, vid. pl. 2. fig. 7.

Copt. biguttatus, thorace mutico, ferrugineus, elytris antice punctato-rugosis, testaceo-maculatis, bidentatis, macula flava.

Long. lin. 8; lat. lin. 2.

I received this insect from Mr. Donovan, and therefore have no doubt respecting the individual species. The elytra, according to the above description, can scarcely be considered as bidentate; they appear as if they were abruptly broken off at their apex. The sexes vary very much in size.

Coptocercus sexmaculatus.

Copt. niger; antennis brunneis; thorace tuberculato et rugoso; elytris 6 *maculis luteis notatis, pedibus rufescentibus.*

Descr.—*Caput* atrum, antennis brunneis. *Thorax* utrinque denticulatus, inæqualis, rugosus, tuberculatus, macula media elevata et glabra. *Elytra* nigra antice varioloso-punctata, postice punctis minoribus, sex-maculata, macula 1^{ma} lutea paullo infra basin, 2^{da} fere media seu melius fasciata, 3^{tia} apicali pallidiore. *Corpus* infra cinereo-piceum; pedibus rufo-brunneis.

Long. lin. 7; lat. lin. $1\frac{3}{4}$.

This species, which appears to have escaped the notice of entomologists, is abundant. I suspect that the male sex will have the denticulation on each side of the thorax more marked than in the female described.

Coptocercus unifasciatus.

Tab. XII. Fig. 6.

Copt. ater, thorace inæquali tuberculato, elytris nigris punctatis et flavo-fasciatis, punctis ternis, maculisque minutis in singulo, inter basin et mediam fasciam positis.

[1] Coptocercus, from *κόπτω, scindo,* and *κέρκος, cauda.*

DESCR.—*Corpus* infra rubro-piceum; pedibus concoloribus, aureo-tomentosis; abdomine nigro et nitido.

Long. lin. 6; lat. lin. $1\frac{1}{2}$.

The above insect I received from Captain Roe of the Swan River settlement in New Holland.

Section 4. *Denticolles.*

Antennæ tomentosæ. Thorace utrinque spinoso; dorso dentato; elytris apice obtusis.

Gen. TRACHELORACHYS[1], nov. gen.

Type of the Genus, *Stenochorus fumicolor.*

Caput exsertum, oculis prominentibus, antennis corpore brevioribus. *Palpi* maxillares mandibulis longiores. *Antennæ* 11-articulatæ, 1^{mo} cylindrico parum difformi, ad basim tenuiori et externe crassiore, 2^{do} brevi subcyathiformi, reliquis fere æqualibus, at extimo minori, apice attenuato. *Thorax* convexus utrinque spinosus, disco spinis armato. *Elytra* thorace quadruplo longiora, depressa, ad apicem obtuse rotundata et inermia. *Pedes* simplices, femoribus haud incrassatis.

Hab. In Nova Hollandia.

TRACHELORACHYS FUMICOLOR.

Trach. fusco-niger; thorace utrinque spinoso, disco spinis quatuor fere in medio armato.

DESCR.—*Elytra* parallela marginibus undique elevatis, ad basim crebre granulata, granulis ad apicem e medio elytrorum magnitudine decrescentibus. *Corpus* infra piceo-nigrum, pedibus pallidioribus et tomentosis, tarsisque aurato-tomentosis.

Long. lin. $10\frac{1}{2}$; lat. lin. $2\frac{1}{2}$.

This insect was obtained from a collection made in the vicinity of Sydney.

TRACHELORACHYS PUSTULATUS.

Trach. flavo-fuscus; antennis tomentosis; thorace concolori utrinque spinoso, spinis binis fere in medio armatis.

DESCR.—*Elytra* marginata; pustulis nigris in lineis sparsim dispositis. *Corpus* infra fusco-rubrum; pedibus subtomentosis.

Long. lin. 8; lat. lin. $1\frac{1}{2}$.

The above insect was purchased out of a New Holland box, along with various nondescripts; most likely they were from Hobart Town.

[1] The above word is formed of τράχηλος, *collum*, and ῥάχις, *spina*.

Section 5. *Femorales.*

Antennæ tomentosæ ; thorace utrinque spinoso, dorso dentato ; elytris transverse sectis ; femoribus incrassatis.

Gen. Meropachys[1].

Caput exsertum, antennis tomentosis undecim articulatis ; 1^{mo} fere ut in *Trach. fumicolori*, at externe crassiori et ovato ; 2^{do} brevi et globoso ; 3^{tio} triplo longiori ; 4^{to} paullo breviori, reliquis gradatim increscentibus, extimo apice subacuto. *Thorax* antice et postice contractus, utrinque in medio spinosus ; dorso dentato. *Elytra* depressa, thorace latiora, postice latiora transverse fissa. *Totum corpus* supra et infra argentea sericie aspersum. *Femoribus* valde incrassatis in medio fortiter globosis.

This genus appears to differ chiefly from *Trachelorachys* in having both the sexes remarkably characterized by their incrassated femora; and it is probable that, as in other New Holland Stenochoridous genera, the length of the antennæ will vary in the sexes.

Meropachys MacLeaii.

Merop. fusco-flava, antennis flavis tomentosis, thorace concolori, utrinque spinoso, maculis binis atris, antice et postice signato.

Descr.—*Elytra* aurata sericie aspersa, ad humeros tuberculata, fascia nigricanti ante apicem posita. *Corpus* infra rubrum nigro et argenteo variegatum. *Pedes* flavescentes, femoribus globosis, nigro-maculatis ; tibiis quatuor posticis medio atratis ; tarsisque pallidis, binis anticis fere omnino nigris, subtusque auricomatis.

Long. lin. 8 ; lat. lin. $1\frac{1}{2}$.

This beautifully sericeous insect is named in honour of William Sharpe MacLeay, Esq., from whom we may shortly expect some valuable communications relating to the entomology of Australia.

Meropachys tristis.

Merop. flavo-fuscus, antennis tomentosis, thorace aurata lanugine obsito.

Descr.—*Elytra* depressa, minutis pustulis lineari serie insignitis. *Corpus* infra rubro-piceum sericie aurata tectum. *Femora* valde incrassata ; tibiis rubro-testaceis ; tarsisque infra auricomatis.

Long. lin. $9\frac{1}{4}$; lat. lin. 2.

The above species was sent to me by Captain Roe from the vicinity of the Swan River settlement. There were also other species allied to the present, but they arrived in too mutilated a state to describe.

[1] Meropachys is formed from μηρὸς, *femur*, and παχὺς, *crassus*.

Conicolles.

Scolecobrotus Westwoodii.

This species was described at p. 109 in the first volume of the Zoological Transactions, and is admirably figured at Plate XV. *n.* 5. It is remarkable for having all the joints of the antennæ, excepting the first three, appearing as if they were eaten by worms. I have lately obtained from Mr. Fortnum the other sex of this singular insect, and now briefly describe it. The antennæ are of a light coral-red colour, which may partly be occasioned by abrasion. The joints of the antennæ do not appear serrated as in the former sex, excepting under a high magnifying power, and even then this character is scarcely perceptible. The spines at the apex of the elytra are wider apart than in the specimen previously described; in other respects the insects accord almost entirely. I have reason to think that both the above specimens are from the Swan River settlement, and am not aware that any others are to be found in our metropolitan, or even in the French collections.

Uracanthus, Hope.

For the description of this genus, *vide* the details published at p. 108 of the Zoological Transactions, vol. i., where only one species was described; two more are now added.

Uracanthus pallens.

Uracan. cervino-brunneus, thorace conico et albo-lineato; elytris pallidioribus apicibus bidentatis.

Descr.—Affinis præcedenti at multo minor. *Caput* fronte forte canaliculata, pubescentia albida tectum. *Thorax* alba linea utrinque notatus, binisque tuberculis ad latera subarmatus, rugisque transversis constrictus. *Elytra* cervino-brunnea, sericea, triangulis in singulo, colore saturatiore, inquinatis. *Corpus* infra brunneo-sericeum, femoribus parum compressis.

Long. lin. 10; lat. lin. 2.

I had originally given the name of *sericeus* to this species, which, as it seems common to all that are at present known, I now change to *pallens.* It was received from Van Diemen's Land in 1839.

Uracanthus marginellus.

Uracan. fusco-brunneus, thorace albo-lineato, elytrisque brunneo marginatis.

Descr.—*Totum corpus* supra tomentosum, capite porrecto et inter oculos parum subcanaliculato. *Thorax* rugis constrictus, tuberculo utrinque posito. *Elytra* albo-pubescentia marginibus brunneis apicibus abrupte truncatis, spinis parum prominentibus. *Corpus* infra concolor, femoribus compressis.

Long. lin. 9; lat. lin. $1\frac{1}{3}$.

I received this insect from Captain Roe of the Swan River. In form it approaches a singular genus named *Stephanops* by Mr. Shuckard; it is however decidedly an *Uracanthus*, and there can be little doubt that *Stephanops nasutus* of the above author belongs to my section of the cone-necked-shaped *Stenochoridæ*.

Section *Conicolles*, Hope.

Genus STRONGYLURUS, Hope.

Type of the Genus, *Sten. scutellatus*, Hope.

Vide Zool. Trans., vol. i. p. 107.

Caput porrectum, oculis prominentibus. *Antennæ* undecim articulatæ: articulus 1^{mus} crassus ad apicem latior quam ad basim; 2do brevi, reliquis gradatim increscentibus, compressis. *Thorax* coniformis antice et transverse truncatus. *Elytra* thorace latiora, parallela apicibus rotundatis. *Femora* in utroque sexu subincrassata, et parum compressa.

STRONGYLURUS SCUTELLATUS.

Tab. XII. Fig. 2.

Strong. fuscus et tomentosus, thorace flavo-ochraceo colore utrinque lineato, medio disci nigricante.

DESCR.—*Scutellum* valde distinctum flavum. *Elytra* fusco-brunnea, fasciisque undulatis parum distinctis notata. *Corpus* infra sordide fuscum, abdomine rubro-piceo, pedibus concoloribus et tomentosis.

Long. lin. $12\frac{1}{3}$; lat. lin. 3.

The above insect I have received from various parts of New Holland; as it is accurately figured, I have not given very full generic details. I must remark, that in the sexes of this genus the antennæ vary very considerably, in one instance exceeding the length of the body, whilst in the other sex they are shorter than the elytra. These Longicorn beetles also vary much in size, which is a remark that appears to apply to most of the *Cerambycidæ* of New Holland. Can the long drought which sometimes prevails in this country be regarded as the cause of *dwarfishness*, which is certainly one of the striking features of the *Coleoptera* of Australia?

STRONGYLURUS VARICORNIS.

Strong. testaceo fuscus, antennis flavo nigroque variegatis. Thorace tomentoso, utrinque dentibus atris armato.

DESCR.—*Scutellum* distinctum et album. *Elytra* fusco-testacea fasciis binis undatis parum distinctis. *Corpus* infra concolor, pedibus tomentosis.

Long. lin. $5\frac{1}{3}$; lat. lin. $1\frac{1}{2}$.

There are in our English collections two other species belonging to this genus; as however I have them not at hand, I must leave others to describe them.

Genus Coptopterus, Hope.

Type of the Genus, *Stenochorus cretifer*, Hope.

Vide Zool. Trans., vol. i. p. 107.

Caput porrectum inter oculos canaliculatum. *Antennæ* compressæ, et fere ut in *Strongyluro*. *Thorax* obconico-truncatus, lateribus rotundatis. *Elytra* thorace latiora parallela; apicibus suboblique truncatis, seu abrupte sectis. *Femora* subincrassata et parum compressa; tibiis subincurvis.

Coptopterus cretifer.

Tab. XII. Fig. 3.

Copt. fusco-brunneus, capite albida macula inter oculos posita.

Descr.—*Thorax* nigro-cinereus variis maculis cretaceis notatus. *Elytra* brunnea maculis nigris aspersa, in quibusdam speciminibus maculæ conjunctæ fascias exhibent. *Corpus* infra fusco-rubrum maculisque variis albidis obsitum. *Pedes* rubro-picei et tomentosi.

Long. lin. $10\frac{1}{2}$; lat. lin. 3.

This insect appears to be abundant at Sydney: there are also other allied species undescribed, and from the vicinity of the Swan River.

Genus Piesarthrius, Hope.

Type of the Genus, *Stenochorus marginellus*.

Vide Zool. Trans., vol. i. p. 112. Genus 12.

Caput exsertum. *Antennæ* valde compressæ, 11-articulatæ. *Thorax* fere tetragonus angulis anticis parum rotundatis. *Elytra* thorace paullo latiora, parallela, interne spinosa, angulis externis rotundatis. *Femora* antica quatuor vix incrassata, posteriora minora; tibiis subincurvis.

Hab. In Nova Hollandia.

Piesarthrius marginellus.

Tab. XII. Fig. 1.

Piesar. flavo-fuscus antennis compressis, tomentosis et pallidis.

Descr.—*Thorax* niger, lateribus flavo-ochraceis. Scutellum distinctum et flavum. *Elytra* testaceo-flava marginibus interne et externe rubro-piceis. *Corpus* infra brunneo-piceum, lateribus pectoris annulisque abdominis utrinque flavo-maculatis, pedibus pallidioribus.

Long. lin. 10; lat. lin. $2\frac{1}{2}$.

This insect I received from Captain Roe of the Swan River, and it is, I believe, unique. I have seen a second species, but have not been able to obtain permission to describe it.

In concluding my remarks on the genera and species of *Stenochoridæ* peculiar to New Holland, I have only to add, that all the above species described are in my possession, and are accessible to those who wish to examine them; and it only remains for me to add, that some of the drawings are executed by Mr. Westwood, and the remainder by Mr. Spry, a talented and rising artist*.

* Since this memoir was read my collection has considerably increased, so much so that the number of *new* species already equals those which are above described; it is my intention, therefore, to submit to the scientific meetings, on a future occasion, a Supplement. I may, however, at present add some observations on the *Stenochoridæ* sent to me by Mr. W. Sharpe MacLeay, who has collected them assiduously in Australia; and as his remarks relate in many instances to localities and habits, they will give us some additional information of a group whose habits are little known. "*Stenochorus*" (says Mr. MacLeay) "is a good genus, and so verily I believe is your family *Stenochoridæ*, as it cannot now be called Fabrician. I think *Stenochorus semipunctatus* a very good type of the family; and the order of affinity of the Longicorn families is, in my humble opinion, nearly as follows:

"1. *Prionidæ*; 2. *Lamiadæ*; 3. *Cerambycidæ*; 4. *Stenochoridæ*; 5. *Lepturidæ*."

Having remarked on the family, &c., Mr. MacLeay then adds his observations on the species I have described. I give his remarks, therefore, nearly *totidem verbis*.

Sp. 1. *S. latus*. This insect is not a native of the interior, I have only found it on the coast, in the heart of logs of *Casuarinæ*; it varies greatly in size.

Sp. 6. *S. punctatus*. Under this name two species seem to be confounded: one, *elytris punctatis anticè subrugosis*; and the other, *elytris anticè punctatis subrugosis, posticè glaberrimis*: one is from Swan River, and the other from Sydney.

Sp. 8. *S. semipunctatus*, Fab. Under this name also two species seem to be confounded. The *S. semipunctatus* apparently has a wide range, occurring at Swan River and Van Diemen's Land. I usually find it under the bark of *Eucalyptus*.

Sp. 12. *S. Acanthocerus*, M. L., is rightly placed by you; it was brought from the coast by Captain King; its length is 12 lines.

Sp. 24. *Meropachys Macleaii* is taken on the flowers of *Leptospermum*.

Sp. 27. *Uracantha triangularis* is common at Ulladolla on the coast; it frequents flowers.

DESCRIPTION OF THE PLATE.

PLATE XII.

Fig. 1. Piesarthrius marginellus.
- *a.* Head seen from beneath.
- *b.* Ditto seen from above.
- *c.* Mandible.
- *d.* *Maxilla* and *palpus.*
- *e.* *Labium* and *palpi.*

2. Strongylurus scutellatus.
- *a.* Head seen from beneath.
- *b.* Ditto seen from above.
- *c.* Mandible.
- *d.* *Maxilla* and *palpus.*
- *e.* *Labium* and *palpi.*

3. Coptopterus cretifer.
- *a.* Head seen from beneath.
- *b.* Ditto seen from above.
- *c.* Mandible.
- *d.* *Maxilla* and *palpus*
- *e.* *Labium* and *palpi.*

4. Stenochorus rubripes.
5. Stenochorus gigas.
6. Coptocercus unifasciatus
7. Stenochorus uniguttatus.
8. Stenochorus Mitchelli.
9. Stenochorus trimaculatus.

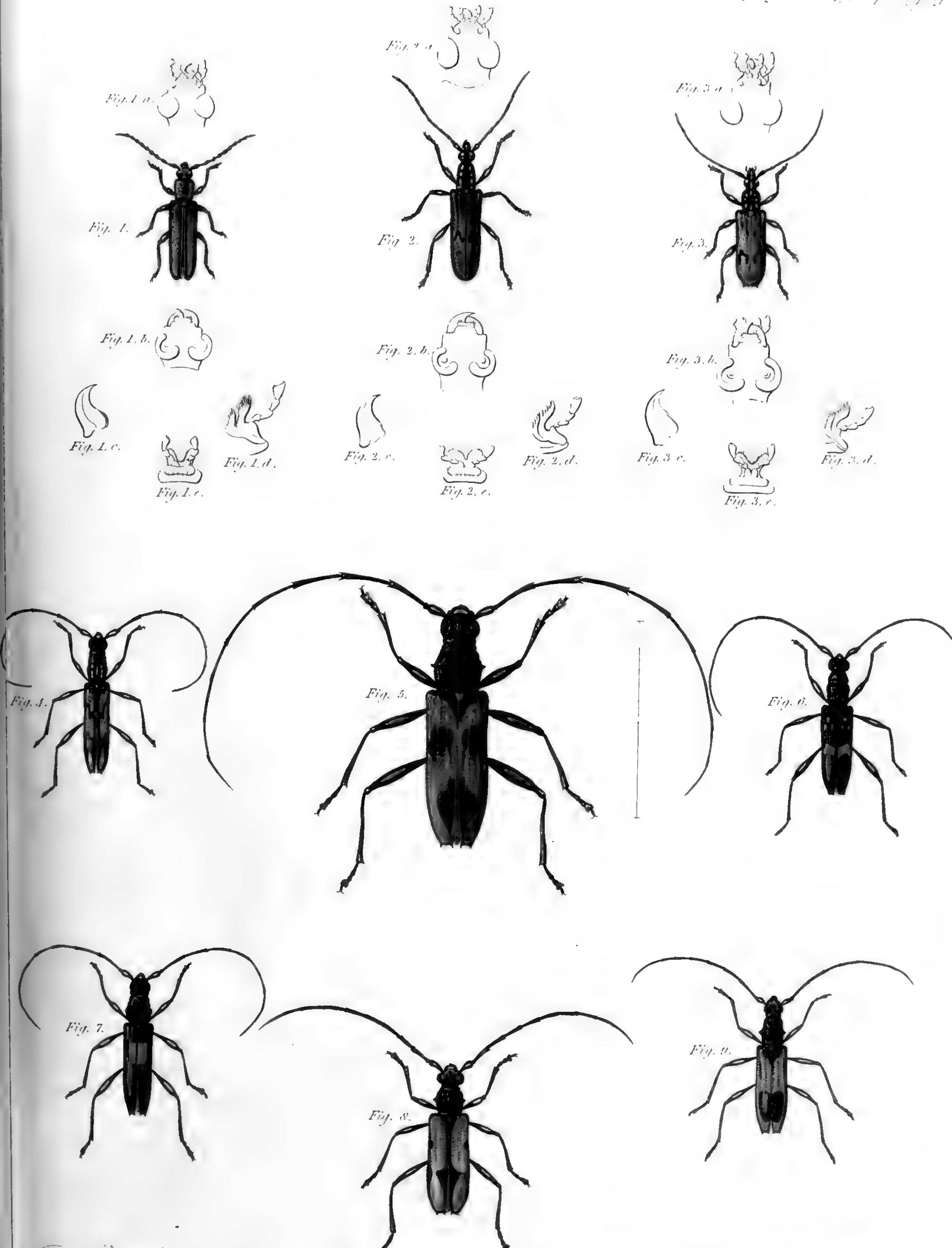


Fig. 1. Pisarthrius marginellus. 2 Stronggylurus scutellatus. 3. Coptopterus cictifer. 4. St[illegible] [illegible].
Stenocherus gigas. 6. Coptocercus unifasciatus. 7. Stenocherus uniguttatus. 8. St. Michelli. 9. St. trimaculatus.

VII. *Description of a new Genus and Species of Sponge* (Euplectella[1] Aspergillum, *O.*). *By* RICHARD OWEN, *F.R.S., F.Z.S., &c. &c.*

Communicated January 26, 1841.

MR. CUMING has entrusted to me for description one of the most singular and beautiful, as well as the rarest, of the marine productions with which his researches in the Philippine Islands have enabled him to enrich the zoological collections of his native country. This production forms part, however, of a member of the lowest class of organized bodies, being the skeleton or framework of a species of Sponge, belonging to the cylindrical and reticulate, or 'Alcyonoid' family. It is a hollow, subcircular, slightly conical, and gently curved case or tube, resembling a delicate cornucopia with the apex removed. It measures eight inches in length, two inches across the base, and one inch and a quarter across the apex, which is truncated. The base or wider aperture of the tube is subelliptical, and is closed by a cap of coarse and somewhat irregular network, gently convex externally, the circumference of which is divided from the walls of the cylinder, like the base of the *Aspergillum* or water-pot shell, by a thin projecting plate, standing out like a ruff or frill. This marginal plate varies in breadth from one to three lines. The parietes of the circular cone consist also of a network of coarse fibres, but these exhibit great regularity of disposition, and intersect each other at definite and nearly equal distances throughout the course of the cone: they consist of longitudinal, transverse, and oblique fibres, the latter being of two kinds, winding spirally round the cylinder, but in opposite directions. The strongest fibres are longitudinal and transverse; they are arranged at intervals of about a line and a half, and mark out square spaces of the same diameter: these spaces are kept of pretty equal size throughout the cone, from the circumstance of the longitudinal fibres diminishing in number as the cone decreases in size: the mode of diminution is not, however, by abrupt termination, but by the gradual convergence and final interblending of two contiguous longitudinal fibres, and the regularity of the interspaces is therefore disturbed at the intervals of such converging fibres. The fibre resulting from this union of two fibres bears a proportionate thickness to the additional material entering into its composition: the nature of such material is demonstrated at the apex of the cone by the resolution of the longitudinal fibres into their component filaments, each fibre dividing at about two-thirds of an inch from their extremity into a fasciculus or pencil of extremely delicate, rather stiff, glistening, elastic threads. The transverse

[1] Der. εὖ, *well*, πλέκω, *I weave.*

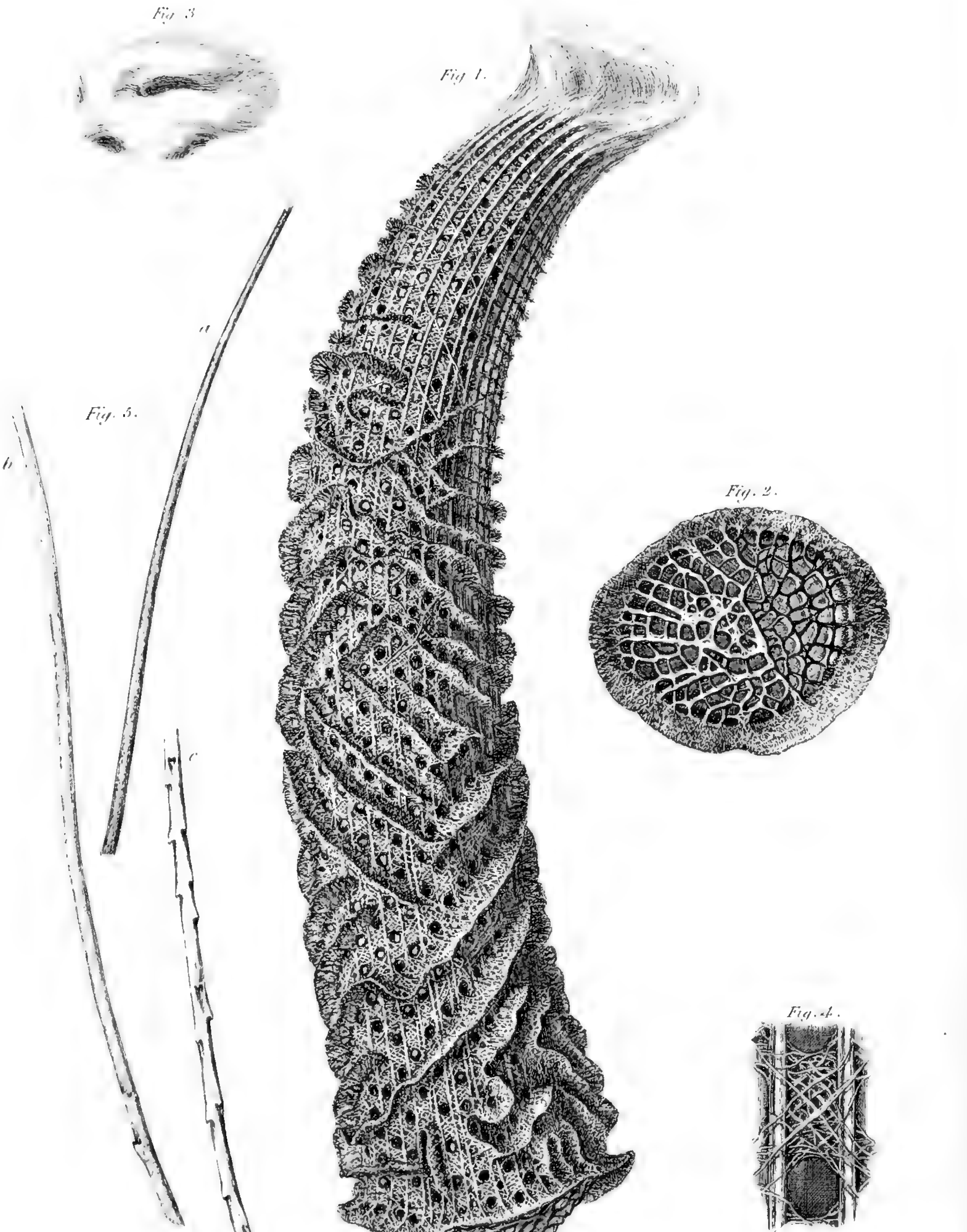
fibres, in like manner, are resolved at the truncated apex of the cone into their component filaments, which intersect those proceeding from the longitudinal fibres, as well as similar pencils from the oblique fibres, the whole forming an irregular silky tuft which almost closes the apical aperture of the cone.

The longitudinal fibres are external to the transverse ones, to which they are connected by both the spiral fibres and by smaller and less regular intersecting fibres at the angles of the squares; the area of each square is thus reduced more or less to a circular form[1]. At about one or two inches from the apex these connecting reticulate fibres begin to rise in the form of narrow ridges from the general surface of the network, and nearer the apex on the convex than on the concave side of the bent cone: these ridges at first are short and interrupted; they are then more extended but irregular in their course, some being transverse, others undulated or curved; but as they approach the base of the cone they are continued into broader ridges, which follow with more or less regularity the course of the oblique spiral fibres; the broadest of these ridges measures two lines and a half: their structure presents an extremely fine and irregular network, disposed for the most part in two plates, which converge as they recede from the general wall of the cone, and coalesce in a sharp and well-defined edge. The component fibres of these reticulations, like those of the main network, are resolved into the fine silky filaments above mentioned: the fibres of the coarse irregular network which closes the basal aperture of the cone, and which constitutes the main characteristic of this Alcyonoid sponge, appear to be directly continued from, and, as it were, to include all those which enter into the composition of the longitudinal transverse and oblique fibres of the wall of the cone; the frill-like ridge above mentioned defining the line of transition from the one to the other. The inner surface of the reticulate parietes of the cone is even; not interrupted by any ridges or processes like those on the outer surface.

The number of the longitudinal fibres at the base of the cone is sixty; that at the smaller end, where they begin to resolve themselves into their constituent filaments, is thirty: the diameter of the longitudinal fibres is about one-fortieth of an inch; that of the transverse fibres is somewhat less: the oblique fibres, where they are most regular, average one-sixtieth of an inch; the longitudinal fibres, where they begin to resolve themselves into their component filaments, expand in the direction of a line passing to the centre of the cone, and not in the direction of the plane of its circumference, maintaining, in the latter respect, nearly the same breadth to their entire unraveling; whilst in the other dimension they equal one line in breadth before they are wholly decomposed.

Small portions of a finely reticulate plate were loosely attached to some parts of the internal surface of the cone: the fibres of these pieces consisted of minute filaments, irregular in their course, branching, anastomosing, and sending off abrupt processes like thorns.

[1] Pl. XIII. fig. 4.



Euplectella aspergillum, Owen.

G.B. Sowerby Junr. Del.

The component filaments of the parietal fibres are chiefly of two kinds; the one[1] simple, cylindrical and smooth, the others[2] barbed at pretty regular distances through their whole extent, like the hair of certain caterpillars: I have also observed a few long filaments, which were simple at one extremity and barbed at the other[3]. These component filaments consist of a material like the dried gluten of marine plants, containing a small proportion of azote, and burning away to a charry silicious residuum.

If the basal aperture of the cone were open, the resemblance to some of the known reticulate Alcyonoid sponges would be very close, especially to that called *Alcyonellum gelatinosum* by M. De Blainville[4] (*Alcyonellum speciosum*, Quoy et Gaimard[5]): its closure by the reticulate convex frilled cap, in the present instance, establishes the generic distinction; and in the exquisite beauty and regularity of the texture of the walls of the cone, the species surpasses any of the allied productions that I have as yet seen or found described. I propose, therefore, to name it *Euplectella Aspergillum.*

Since the foregoing description of the *Euplectella* was penned, that unique specimen has been purchased by my friend William John Broderip, Esq., whose cabinet it now graces. It has been entrusted, with his wonted liberality, to Mr. George B. Sowerby, Jun., during the long period which has been devoted to the engraving of so delicate and complicated a subject, and I cannot conclude without expressing my obligations for the facilities thus afforded to the accomplished artist, and for his zealous and successful endeavours to achieve a faithful representation of the *Euplectella.*

PLATE XIII.

Fig. 1. Side view, natural size.
2. Basal extremity.
3. Apical extremity.
4. Single interspace or open cell and surrounding finer mesh-work, magnified.
5. Component filaments magnified 150 diameters: *a*, Smooth filament; *c*, Toothed filament.

[1] Pl. XIII. fig. 5, *a*.
[2] Ib. fig. 5, *c*.
[3] Ib. fig. 5, *b*.
[4] Manuel d'Actinologie, 8vo. 1834, p. 529.
[5] Zoologie de l'Astrolabe, 8vo. 1833, p. 302; Planches, Fol. Zoophytes, pl. 26. fig. 3. If the recognition of the generic or specific identity of the specimen here figured be impracticable, by reason of its mutilated condition, the generic name applied to it cannot be adopted while the Lamarckian genus of freshwater polypes, *Alcyonella*, is retained in zoology.

VIII. *Descriptions of some Coleopterous Insects from Tropical Africa, belonging to the section* Heteromera. *By* J. O. Westwood, *Esq., F.L.S. &c.*

Communicated October 12, 1841.

I AM induced to offer the following memoir to the Zoological Society, in the first place, because the insects therein described are of the greatest rarity; and secondly, because they illustrate the fact expressed in most zoological groups, of the existence of certain species or genera of gigantic size compared with the ordinary size of the species of the group, and which in general offer material aberrations from the real types of the family to which they respectively belong; *Manticora* amongst the *Cicindelidæ*, the Goliath beetles amongst the *Cetoniidæ*, and *Fulgora* amongst the *Fulgoridæ*, may be cited as illustrations of this peculiarity. In the present case, *Chiroscelis* and the other groups about to be described in this paper are amongst the giants of the *Tenebrionidæ*, to which family I refer them, although they exhibit several characters at variance with those of the typical *Tenebriones*. Thus in *Chiroscelis* we have the form and colours of *Tenebrio*, but the mandibles are destitute of the membranous piece inserted in a notch on the inside. *Odontopus*, again, in its metallic characters, resembles the *Helopidæ*; whilst the same character, joined to a dilated convex form in *Pezodontus*, Dej. Cat., and *Metallonotus*, G. R. Gray, and especially the large terminal joint of the antennæ, gives these insects some relation with *Lagria*.

Chiroscelis, Lamarck, Annales du Muséum, tom. iii. p. 260 (1804).

Species 1. Chiroscelis bifenestra, Lamarck.

This genus, *Chiroscelis*, was established for the reception of an insect respecting whose native country there is some doubt; Lamarck stating, "Ce Coléoptère habite vraisemblablement dans la Nouvelle Hollande; car il se trouvait parmi ceux de cette contrée que le Capitaine Baudin a envoyé par le vaisseau le Naturaliste." (*op. cit.* p. 263); whilst Latreille states, "Habitat in Australasia; insula S^te^ Marie, Dom. Dom. Peron, Lesueur," (Gen. Ins. ii. 144), adding, however, "Speciem alteram priori fere similem, at paulo minorem, et maculis abdominalibus nullis, ex Africa attulit Peron." The comparison thus made with the African species leads us to inquire the size of Lamarck's insect, which is stated to have been "un peu plus de 4 centimètres (un pouce et demi)" [or rather, 1 inch 8 lines English] "de longueur," and his figure, "de la grandeur naturelle," (pl. 22. fig. 2.) exactly accords with this description. The other distinguishing character mentioned by Latreille is a sexual one, and will not therefore assist us. It is to be observed, however, that the characters of Lamarck's insect, except in size, appear to agree with the African species, and especially in the form and size of the spots on the second segment of the abdomen. As, however, the characters which separate the species in this genus appear very slight, I think it not improbable that a minute comparison would show some other distinction than that of size. I therefore, for the present, regard Lamarck's insect as specifically distinct, both in size and locality, from those of the African continent.

Species 2. CHIROSCELIS DIGITATA.

Tab. XIV. Fig. 1.

The *Tenebrio digitatus* of Fabricius (Syst. Eleuth. i. p. 145) is however referable to this genus, and it is surprising that its connexion therewith should have been overlooked both by Schönherr and the French entomologists[1]. The habitat of this insect is Guinea, and its description accords with specimens received from Sierra Leone by the Rev. F. W. Hope, as well as with one communicated to him from Copenhagen (where Sehestedt's cabinet is preserved in the Royal Museum) by M. Westermann. The following are the dimensions of these specimens:—

Length of the head	3 lines English.
——— pronotum . . .	$4\frac{1}{8}$ ———
——— elytra	$11\frac{1}{8}$ ———
	—— $18\frac{1}{4}$ lines.

The head is rather flat and uneven above. The labrum is not symmetrical, the left side being rather more produced than the right. This, which is the case in three specimens I have examined, is owing to the left mandible, which laps over the right-hand one, and pushes the left angle of the labrum upwards and forwards. The mandibles are different in form, the right-hand one having a single incision within, near the tip, whilst the left-hand one has a similar incision, as well as a strong tooth on the upper side near the tip, below which is a very deep incision, the base being internally produced into an acute angle; the maxillæ are terminated by a dilated lobe, which is thickly clothed with long hairs; the inner lobe is horny and bifid at the tip; the stem of the maxillæ is externally dilated into a flattened angular projection beneath the insertion of the palpi, of which the terminal joint is scarcely thicker than the preceding. The labial palpi, on the contrary, have the last joint large and securiform. The mentum has its anterior angles rather acute. The anterior angles of the clypeus are produced, forming a sinuated emargination in which the labrum is fixed; in the centre of this emargination are two slightly raised projections; behind this is a deep transverse impression, each end terminating in a thickly punctured space which is advanced forward; a similar punctured space exists on each side of the eyes; within and between this is a short, transverse,

[1] It is probable that the doubtful reference made by himself of this insect to his *Tenebrio fossor*, Ent. Syst. i. 112, may have led to this. The last-named insect, which was described from the Banksian cabinet as a native of the Cape of Good Hope, is a Carabideous insect of the genus *Zabrus*.

impressed space with raised margins. The sides of the head in front of the eyes are produced and elevated above the insertion of the antennæ. The prothorax, or rather the pronotum, is marked in the sex possessing the two patches on the second abdominal segment (and which I regard as indicating the female[1]) with a deep and large puncture on the middle of the anterior margin, which is wanting in the individuals which have not the abdominal patches. These patches are of considerable size and of a somewhat triangular-ovate form, the narrow end being placed inwardly, and turned towards the posterior margin of the segment. The legs, in all the specimens I have seen, present no sexual distinguishing character. The middle and posterior tibiæ are scarcely thicker at the tip than in the middle,—they are nearly straight; the anterior tibiæ beneath are thickly and roughly punctured, and the tarsal joints are slightly produced beneath. The spur of each of the fore tibiæ is small, and forms the tip of the intermediate apical finger; the four hind tibiæ have the spurs of equal size.

I consider the figure given by Guérin in the 'Iconographie du Règne Animal, Insectes,' pl. 30. fig. 5, to represent this species. Various details of it are also represented in Mr. Hope's 'Coleopterist's Manual,' part iii. pl. 3. fig. 3. *a—l.*

I likewise regard the figure published in Erman's 'Reise um die Erde,' t. 15. f. 11, as intended for the *digitata* of Fabricius, although it is represented as being only $15\frac{1}{4}$ lines long, which may however perhaps be considered as proving it to be rather a large specimen of the next species. At all events, Dr. Klug's observation, that Lamarck's *bifenestra* " ist sehr wahrscheinlich dieselbe art in dem Beschreibung und Abbildung die ansehnlichere grosse abgerechnet, sehr wohl passen," seems to me not correct.

P.S.—Since the above was written I have seen two specimens, in the collection of the Rev. F. W. Hope, brought from Ashantee, of a castaneous colour, the head in one of them being blackish. They both agree together in form, size, and structure; in one, however, the two abdominal patches are wanting, and the pronotum is marked with two impressed punctures on the disc towards the anterior margin, which are wanting in the other. I consider it most probable, therefore, that these specimens are sexually distinct.

Species 3. Chiroscelis bifenestrella.

Tab. XIV. Fig. 2.

C. nigra nitida, capite minus rugoso, mandibulis minus dentatis, maculis duabus abdominis ♀ minutis rotundatis, margineque antico pronoti haud puncto notato, tibiis quatuor posticis fere rectis; intermediis ad apicem magis dilatatis.

Long. corp. vix lin. 14.

Hab. in Guinea. In mus. nostr. Commun. Dom. Raddon.

There is a very close general resemblance between this and the last. In addition, however, to the smaller size, there are several characters which I have not hesitated in

[1] I must refer for my reasons for regarding these individuals as females, and the patches as incapable of emitting any light (as suggested by Lamarck), to my 'Introduction to Mod. Class. of Ins.,' vol. i. pp. 320, 322.

regarding as sufficient to constitute a distinct species. The head, although marked with the same impressions, has them much shallower, so that the head appears smoother. The right mandibles have fewer teeth, and those they possess are smaller and more obtuse, the tip itself being truncate or blunt. The maxillary palpi have the terminal joint evidently much thicker than the preceding, and the last joint of the labial palpi is ovate. In my specimen the front margin of the pronotum has no deep impressed puncture in the middle, although the second joint of the abdomen is furnished with the two spots indicating the female sex. Here, however, these spots are very small and round. The anterior tibiæ are bent more inwards, the four hind ones are straighter; their tips, on the other hand, especially in the middle feet, are more dilated. I have represented the wing of this species in order to show the difference which exists between it and *Tenebrio* in the position of the transverse vein at the end of the discoidal cell, and in the large basal internal cell marked with a *. The short row of punctures on each side of the scutellum is very distinct.

Mr. Melly possesses a specimen from St. Andrew's in Africa, near the equator, which is $13\frac{1}{2}$ lines long. It is of a dark castaneous colour with the legs darker, probably the result of immaturity. I am not able to speak of the sex of this specimen, or the shape of the abdominal spots, if a female, owing to the absence of Mr. Melly from this country.

Species 4. Chiroscelis Passaloides.
Tab. XIV. Fig. 3.

Nigra nitida, vertice trituberculato, tibiis latissimis planis, anticis serratis, posticis intus versus apicem dente armatis.

Long. corp. lin. $19\frac{1}{2}$—$20\frac{3}{4}$.

Hab. in Guinea. In mus. nostr. Comm. Dom. Raddon.

The head is finely punctured, with the angles of the clypeus and the margins of the head before the eyes elevated, the latter extending outwards beyond the eyes, near the inner and anterior margins of each of which is a raised tubercle, in front of which runs a transverse impressed line, and there is a larger tubercle between the eyes. The front margin of the clypeus is slightly emarginate; the labrum is subquadrate, with the anterior margin produced in front and ciliated; the mandibles are strong and curved, each terminating in three teeth, the lateral ones being smallest; they have also a strong truncated tooth near the base, and are without any intermediate membranous space; the maxillæ have the stipes dilated behind the base of the palpi; the outer lobe is subarticulated, and not dilated at the extremity; the inner lobe is terminated by a bifid corneous point, and internally ciliated; the maxillary palpi have the terminal joint not thicker than the two preceding ones, and slightly bent outwards, with the tip obliquely truncate; the mentum has the sides dilated and rounded off, without any anterior angles, and without the base being narrowed; the labial palpi are slender and short, with the last joint not enlarged. The antennæ are very short, being only $2\frac{1}{4}$ lines long, with the joints transverse and setose, the last joint being much larger than the preceding, and rounded. The prothorax is nearly square, with the angles rounded off and the posterior margin slightly emarginate in the middle; it is slightly marginated all round. In my smaller specimen the disc has two impressed punctures placed rather wide apart, and at a little distance in front of the centre of the disc; the space between the prothorax and elytra is greater than in the preceding species. The elytra are scarcely broader than the prothorax, with the sides parallel; each has nine simple striæ, which are obliterated at a short distance before the extremity. The legs are very robust; the femora channeled beneath for the reception of the tibiæ, which in all the feet are broad and flat, all being nearly of equal size; the anterior are strongly serrated on the outer edge as well as at the tip; there is also a sharp point on the inside at the tip, exclusive of the spur; there is a deep impression along the upper side, into which the tarsi fall back; on the inside the tibiæ are very rugose, and there is a sharp angular point near the middle; the four hind tibiæ are flat and dilated at a short distance from the base, the extremity being obliquely truncate and toothed, and the inside having a small tooth near the extremity. The tarsi are short, with the underside of the basal joints produced into a short and rather curved point; in all the tarsi the penultimate joint is distinctly longer than the preceding.

The abdomen, in both my specimens, is destitute of any appearance of the patch, although one of them, the smaller, from having two impressions on the pronotum, might be considered (from analogy) to be of the same sex as the specimen of *Ch. digitata*, which has the front of the pronotum marked with a deep puncture, and the abdomen furnished with the two patches.

Prioscelis, Hope, Col. Manual, iii. p. 128.

Priopus, Hope, ib. p. 73.

Iphius, Dej. Cat. (Sine descr.)

Type of the genus, P. Fabricii, Hope, *op. cit.* p. 127.

The following are the only characters given of this genus by Mr. Hope:—" Caput magnum, antennis moniliformibus, articulis quinque ultimis magnitudine increscentibus et pubescentibus, ultimo elongato, apice conico. Thorax antice et postice latitudine æqualis, lateribus extrorsum convexis. Elytra sicut in *Chiroscele*. Femora canaliculata, bina incrassata denticulata, mediis postice foveatis et subdenticulatis; posticis fortiter serratis. Tibiæ anticæ incurvæ, sparsim dentatæ; mediis fere rectis, postice [sc. versus apicem] incrassatis et dentatis, posticis valde incurvis, clavatis et intus fortiter serratis."

These characters are exclusively taken from the type, and would exclude *Tenebrio serratus* of Fabricius and the other species described below, which I regard as species of the same group.

Comparing the characters of these species with those of *Chiroscelis* and the allied genera, it is evident that the gradual dilatation of the terminal joints in the antennæ, the narrowed form of the anterior tibiæ, which are never toothed externally, the less laterally dilated mentum, and the securiform maxillary palpi, are the chief distinguishing characters. There likewise appears to be a difference in the form of the feet of the opposite sexes which we do not find in *Chiroscelis*; and the individuals which have less strongly curved tibiæ, indicating them to be females, have no patches upon the second segment of the abdomen. From the following groups they may be at once distinguished by the larger size of the quadrate thorax, shorter feet, and want of metallic tints.

Regarding *P. Fabricii* as the type of the genus, the others will form a separate division.

Division 1.—*Clypeus antice haud emarginatus, margine antico in medio unituberculato. Mandibulæ intus vix dentatæ. Maxillarum lobus internus, apice corneo bifido. Prothorax suboctagonus. Elytra ad humeros acute angulata.* (Prioscelis *proprie sic dicta.*)

Species 1. Prioscelis Fabricii, Hope, *l. c. suprà.*

Tab. XIV. Fig. 4.

"*Ater, thorace glabro, elytris elongatis et* [*punctato-*] *striatis, tibiis incurvis et serratis.*"

Long. corp. lin. 20; mens. angl. [nec 18]; lat. proth. lin. 5; lat. elytr. fere lin. 6, [nec 7].

Hab. in Sierra Leone. In mus. D. Hope, e mus. D. Lee.

The head is considerably narrower than the prothorax; under a lens it is finely rugulose. The clypeus is biemarginate in front, the centre forming a prominent lobe; the lateral margins of the head in front of the eyes are very much elevated, with a deep, transverse, slightly curved furrow running across the middle of the head, and between the eyes is a longitudinal impression; the space between the eyes is somewhat elevated. The antennæ are $3\frac{1}{2}$ lines long; the joints, from the 3rd to the 7th, are moniliform and glabrous, the remaining gradually dilated and covered with fine short pubescence. The mandibles are strongly curved; the right-hand one is destitute of teeth, but the left-hand one has a short tooth both above and below at a short distance from the apex; the maxillæ have a produced lobe on the outside, beneath the insertion of the palpi, which have the terminal joint strongly securiform. The mentum is dilated at the sides, and somewhat cordate-truncate; the labium transverse, with the middle of the front margin forming a small angle; the labial palpi are but slightly dilated at the last joint. The prothorax is somewhat quadrate with all the angles cut off, so that it appears suboctagonal; it is margined all round, and under a lens appears very finely punctured; it has, moreover, two larger punctures on the disc before the middle, and there is a slight oblique impression between each of these punctures and the anterior angles. The elytra are an inch long, and broader than the prothorax; they have the sides nearly parallel, with the basal external angle (above the shoulders) acute; each has nine punctured striæ, which do not extend quite to the extremity, becoming confluent before they are obliterated; at the base next the suture is a slightly determined short stria of punctures. The anterior femora are curved; the inner edge is channeled, and the front margin of this channel is denticulated. The tibiæ are rather slender, and much curved in the middle, where they are denticulated within; near the base within they are angularly produced, and from the middle to the tip on the outside they are dilated and channeled; the inner angle of the tip forms a hook, which is externally pubescent. The middle femora are less denticulated than either the anterior or posterior pair; the middle tibiæ are nearly straight, but are suddenly dilated within and denticulated beyond the middle, the inner angle forming an acute incurved point; the hind tibiæ are much curved, the inner edge being strongly toothed; the lower portion of this edge is gradually dilated within and very rough, its margin being also denticulated; the tarsi are nearly of equal length, the penultimate joint being evidently longer than the preceding; the body beneath is black, finely punctured, and slightly clothed with short aureous pubescence; the third segment of the abdomen has a transverse carina near the hinder margin.

P.S.—The Rev. F. W. Hope has recently obtained another specimen from Ashantee, which is only 19 lines long, and of a rather more slender appearance, with a smaller head and punctato-striate elytra; the feet, however, are armed, as in the type of the species.

Division 2.—*Clypeus antice emarginatus, margine antico haud tuberculato. Mandibulæ multidentatæ. Maxillarum lobus internus, apice corneo integro. Prothorax subquadratus, magis transversus. Elytra humeris rotundatis.* (*Iphius*, Dej. Cat. sine descr.)

Species 2. Prioscelis (Iphius) serrata.

Tab. XIV. Fig. 5.

Tenebrio serratus, Fabricius, Ent. Syst. i. 111. 4; Oliv. Ins. 57. t. 1. f. 1.

The Fabrician description, derived from a specimen from Sierra Leone, in the Banksian cabinet, is as follows:—"T. glaber ater; elytris striatis, tibiis posticis serratis. Caput exsertum, basi attenuatum. Thorax nitens. Pedes atri, femoribus canaliculatis. Tibiæ posticæ incurvæ, *elevatæ*[1], intus serratæ."

As there is much resemblance between the species of this group, and the characters are minute, I have drawn up the following description from the Banksian specimen itself, described by Fabricius. The insect is 16 lines long, the elytra being 9½ long and 4½ wide, and the prothorax 3½ long. The thorax is subquadrate and margined; it has the hinder angles narrowed off; the disc is without any large impressed punctures. Between the eyes is a short longitudinal impression. The anterior tibiæ are curved and dilated at the tip, especially on the under part of the outer edge, which forms a strong

[1] I apprehend the word *elevatæ* is a misprint for *clavatæ*.

angular projection; the middle tibiæ are nearly straight, slightly dilated at the tip on the outside. The hind femora are serrated behind, with a strong tooth near the tip. The hind tibiæ are curved and internally serrated; they are dilated at the tip, the surface within being very rugose; on the outside the lower edge of the limb is angularly produced. Each of the elytra has nine punctured striæ, with a few punctures placed longitudinally near the suture. Its colour is black.

Although uncertain at present respecting the sexual distinctions of these insects, I am induced to regard the insect next described as specifically identical with the preceding.

The entire length is 16 lines: the head is nearly $3\frac{1}{2}$ inches long; the prothorax $3\frac{1}{4}$ long and 4 broad; the elytra $9\frac{2}{3}$ long and $4\frac{3}{4}$ wide: the body is very shining and of a pitchy black colour, the elytra being rather more castaneous. The clypeus is widely impressed with small punctures; the hind part of the head is glabrous, and behind the eyes thickly punctured; the clypeus is deeply emarginate; the lateral margins of the head in front of the eyes are much elevated, a deep and curved fossula extending between the raised part across the head; in the centre this fossula extends a little backwards; there is also a shallower and more curved fossula, extending from the hind angles of the eyes. The labrum is quadrate, punctured and ciliated along the front margin, which is rounded and entire; the mandibles are very strong and acute, the right-hand one having a strong tooth in the middle and another much smaller beneath near the tip; the left-hand one has a smaller tooth in the middle and the extremity divided into three teeth, the two side ones being small and at a little distance from the tip; the maxillæ have the corneous extremity of the inner lobe entire, but oblique; the maxillary palpi have the last joint slightly securiform; the mentum is cordate-truncate, and the labium transverse-quadrate with the angles rounded off, the middle of the fore margin being slightly indented; the labial palpi have the terminal joint slightly securiform; the antennæ are three lines long, the last joint oblong with the outer angle rounded. The prothorax is transverse-quadrate, the anterior angles being prominent, the sides very slightly rounded; the posterior angles rounded off, and not extending to the hinder acute margin, so as to appear slightly emarginate; on the disc in front of the centre are two punctures wide apart. The elytra have nine finely punctured striæ on each, with some irregularly placed punctures near the scutellum. The anterior femora are very thick and channeled within, without any tooth near the tip. The tibiæ are but slightly bent, and gradually dilated beyond the middle on the under side of the channel; the apex being obliquely truncate, the inner angle acute. The middle femora have the indication of a tooth only on the hinder edge near the tip; the tibiæ are nearly straight, and but little dilated at the tip. The hind femora have a strong obtuse projection near the tip within, and the hinder margin is rugose; the hind tibiæ are nearly straight, very slightly and gradually dilated, and with the inside serrated; the surface rough with oblong punctures.

The under-side of the body is pitchy brown, and the abdominal segments are simple.

This description is made from a specimen in the collection of the Rev. F. W. Hope, received from M. Westermann of Copenhagen, under the name of *T. serratus*, and as a native of Guinea. It also exactly accords with a specimen in the cabinet of the British Museum, except that the latter is rather shorter than Mr. Hope's individual.

Mr. Melly possesses a specimen which also appears to me to be identical with Mr. Hope's above described, agreeing with it in the transverse thorax and form of the tibiæ; it is however only $14\frac{1}{2}$ lines long, the hind femora have two subapical teeth, and the hind tibiæ are but slightly serrated within.

Species 3. Prioscelis (Iphius) Raddoni.

Tab. XIV. Fig. 6.

P. antennis brevibus, articulo ultimo quadrato; tibiis anticis curvatis, apice dilatatis, posticis intus serrulatis, extus ad apicem subito dilatatis; prothorace transverso-quadrato, punctis duobus minutis distantibus versus marginem posticum.

Long. corp. lin. 14; capitis, 3; prothor. 3; lat. $3\frac{1}{2}$; elytr. long. 8, lat. 4.

Hab. in Guinea. In mus. nostr. Comm. Dom. Raddon.

The insect is black, except the elytra and abdomen, which are pitchy; the head is punctured, the disc being more sparingly so than the clypeus and hind part; the mandibles are toothed as in the preceding species, and the head similarly channeled; the space between the eyes is however rather more elevated, with a circular shallow impression in the middle. The maxillary palpi are rather more securiform than in the preceding, and the labium has a tubercle between the base of the labial palpi; its anterior margin is also produced in the middle into a small point. The antennæ are not longer than the head, with the terminal joints considerably dilated and transverse, the last one being nearly quadrate, with the outer angle rounded. The prothorax is quadrate, or rather slightly broader behind than in front, very glabrous and margined, the anterior angles not so prominent as in the preceding, but the posterior angles similarly subemarginate: each of the elytra is marked with nine punctated striæ; the 3rd and 4th, 5th and 6th, 7th and 8th striæ being confluent together before the tip, the 5th and 6th not extending so far as the confluence of two on either side. The femora are similar to those of the preceding, except that the subapical angular projections of the hind ones are smaller, the anterior tibiæ are more curved, and the dilatation at the tip on the outside more sudden; the middle tibiæ are also rather more curved and slightly dilated, and the hind tibiæ are considerably more dilated on the outside at the tip.

I have named this species after W. Raddon, Esq., the celebrated engraver, whose zeal for entomology has led to the discovery of many rare and new species of insects.

P.S.—The Rev. F. W. Hope has recently received two specimens from Ashantee agreeing with my individuals in length, but being throughout broader and more robust, of a black colour, less shining, with the punctated sulci of the elytra deeper, the clypeus less punctated, the forehead without the impressed dot between the eyes, and the tibiæ, especially in the hind feet, rather more serrated. These may possibly be sexual distinctions.

Species 4. PRIOSCELIS (IPHIUS) CRASSICORNIS.

Tab. XIV. Fig. 7.

P. atra glabra, antennis longioribus crassioribus, femoribus omnibus ante apicem interne bidentatis, tibiis compressis.

Long. corp. lin. 13; capitis, 2; prothor. $2\frac{1}{2}$; lat. $3\frac{1}{4}$; elytr. long. $8\frac{1}{4}$, lat. 4.

Hab. in Guinea. In mus. nostr. Comm. D. Raddon.

This species has quite a different habit from the two preceding: the head in front is thickly punctured, the hind part, on the contrary, is nearly smooth; the clypeus is deeply emarginate, and the margins of the head in front of the eyes very much elevated, between which elevations is a curved transverse impression; the mandibles have one tooth rather beyond the middle and another minute one beneath the tip. The maxillary palpi are strongly securiform; the labium has a slight projection in the middle of the anterior margin; the palpi have the last joint subcylindric and scarcely thicker than the preceding. The antennæ are as long as the head and half of the prothorax, and gradually dilated from the base to the tip, the basal joints being glabrous and subglobose, whilst the 8th to the 10th are transverse and pubescent as well as the 11th, which is ovate and pointed at the tip; the prothorax is broader than long, the anterior angles scarcely prominent, the sides slightly rounded, the edge being indistinctly crenulated and marginated; between the middle and hind margin are two deep punctures wide apart. The elytra are wider than the prothorax, with the sides nearly parallel; they are more depressed than in the preceding, with nine slightly punctured striæ on each, which are effaced at a little distance before the apex. All the thighs are furnished near the tip within with two short acute spines, the hinder margin being entire; all the tibiæ are compressed, the front or upper surface being as broad throughout as the hind or lower side; they are nearly straight, and gradually become rather broader to the tip, the outside of which is channeled for the tarsi; the hind pair of tibiæ are the broadest; these have the inner margin almost straight, but the outer margin is sinuated in the middle, or in other words, the limb is dilated beyond the middle on the outer edge; the same character exists, but not so strongly, in the middle tibiæ; the under side of the body is pitchy; the abdomen does not present any peculiar character.

P.S.—Mr. Hope possesses a specimen from Sierra Leone agreeing with mine in general characters and in the curvature and toothing of the feet, but being $1\frac{1}{2}$ line shorter, the head rather narrower, the antennæ rather shorter, with the terminal joints much narrower. It is, I presume, of the opposite sex to the one described above.

PYCNOCERUS, Hope MSS.

PACHYLOCERUS, Hope, Col. Man. iii. p. 186 [1].

ODONTOPUS, pars. Silbermann; Laporte.

IPHICERUS, Dej. Cat.

Type of the genus, P. WESTERMANNI, Hope, *l. c.*

Tab. XV. Fig. 2.

This group is at once distinguished from the preceding by having the club of the antennæ formed of three joints and by its metallic colour, and from the following by its elongated narrow form and punctate-striated elytra. In the typical species the front of the clypeus is bisinuated; the sides of the head strongly elevated in front of the eyes, having a curved transverse impression between the elevated parts; along the inside of each eye also extends a straight impressed line, and the raised part between the eyes terminates in a semicircular depression: the antennæ are terminated by a three-jointed club, the 9th and 10th joints being glabrous, short, broad, each extending over the base of the next; the 11th joint is larger than the others and pubescent; the labrum is transverse and entire; the mandibles are not furnished with any strong teeth; the maxillæ have the inner lobe terminated in a horny point; the maxillary palpi are not securiform, the last joint being but slightly broader than the preceding; the prothorax has the margin entire, being broadest behind, but with all the angles rounded off; it has two impressed punctures in front of the middle; the elytra are nearly parallel and punctate-striated. The anterior femora are thicker than the four posterior; all have the under edge slightly serrated, and the anterior have a short spine near the tip within; the four anterior tibiæ are curved, with an angular projection before the middle; the tips are externally channeled for the reception of the tarsi, the basal joint of which is attenuated at the base; the hind tibiæ are nearly straight.

The length of the body in the typical specimen in Mr. Hope's collection is 15½ lines long, and the elytra are nearly 5 lines broad; its colour is of a chalybeous blue, the thorax more uniformly black, and the elytra more brassy, especially at the sides, which are coppery. It inhabits Sierra Leone.

Mr. Hope possesses two other specimens from the same locality, which he regards as varieties. In one, which is 13½ lines long, the head, antennæ and legs are chalybeous black; the pronotum rufo-piceous, with two punctures on the disc; the elytra are ferruginous brown, with nine punctured striæ on each, the punctures being distinct and the space between the striæ smooth and regular; the legs rather more slender; the ungues longer and acute, and the setæ on the underside longer; the body beneath is rufo-piceous and submetallic.

[1] This name had been previously employed by Mr. Hope for a singular genus of Longicorn Coleoptera, in the First Part of the Transactions of the Entomological Society, p. 19.

The other individual is scarcely 13 lines long, brassy black above, with golden green elytra; the anterior margination of the prothorax is not interrupted in the middle, as it is in the larger specimen; the two punctures on the disc are almost obsolete; the antennæ are proportionably rather shorter, with the three terminal joints more distinct; the feet are formed as in the last-described specimen; the elytra are much more rugose; the punctures of the striæ much less regular, especially at the sides, and the space between the striæ very unequal and irregular[1].

Species 2.—The *Odontopus costatus* (Silb.Rev. Ent. Coleopt. No. 4.), which Silbermann places at the head of his genus, evidently belongs to this group, and I should have accordingly substituted his generic name for that adopted above, but that he has evidently drawn his characters from the species he names *violaceus*, describing the terminal joint of the maxillary palpi as swollen and securiform, which is not the case in *Pycnocerus*. His *P. costatus* is however evidently distinct from *P. Westermanni*; the corneous elevation in the middle of the clypeus, fulvous palpi and "cuisses unidenteés de chaque côte à l'extremité intérieure," will at once serve to distinguish them.

Odontopus, Silbermann.
Pezodontus, Dej. Cat.

I accordingly restrict the genus *Odontopus* to the species which have the elytra dilated and not striato-punctated, and in which the maxillary palpi are strongly securiform, and in which we find a difference in the structure of the feet, the males having the two anterior tibiæ with two teeth at the tips: the terminal joints of the antennæ are distinct.

Species 1.—To this group belongs the *Tenebrio cupreus*[2], Fabr. Ent. Syst. i. 110. (which from the description, "pedes omnino inermes," must evidently have been a female), to which as a variety is apparently to be referred the *Odontopus violaceus* of Silbermann, Rev. Ent. i. pl. 4. The elytra of the specimens which I have seen of this insect have, however, constantly been of a fine purple, without any coppery tint. The femora have not the two short acute spines near the tip beneath, observable in the next species. The length of this insect is 17 lines. Laporte gives the two insects as specifically distinct, but with an expression of doubt.

Species 2. Odontopus tristis.

O. chalybeo-ater, capite et prothorace opacis, tenuissime punctatis, hujus marginibus lateralibus crenulatis, elytris subviridibus magis nitidis, valde et irregulariter punctatis, sutura

[1] Is it possible that the *Tenebrio sulcatus* of Fabricius from Guinea (Ent. Syst. i. 110) can be identical with the *P. Westermanni*? Mr. Hope refers it to the genus *Nyctobates* of Guérin, but it seems to me to belong to this group. It is described of the size of *T. cupreus* (*Odontopus violaceus*, Silberm.), that is, about an inch and a quarter long, with the thorax entire and the elytra striated and coppery. It is true that all the femora are bidentate near the tip, but this may be a sexual character.

[2] Tab. XV. Fig. 3.

lineisque tribus tenuibus longitudinalibus lævibus, femoribus simplicibus, tibiis anticis apicem versus intus dente instructis, tibiis posticis curvatis, intus sinuatis.

Long. corp. lin. $12\frac{1}{2}$.

Hab. Senegallia? In mus. nostr.

The head and prothorax are of a chalybeous black colour; the antennæ have the four terminal joints manifestly larger than the preceding and pubescent, whilst the others are shining; the clypeus is broad and elevated, and separated from the vertex by a nearly straight line; the eyes are wide apart; the square space between them has three slightly impressed longitudinal channels; this part is separated from the hind part of the head by a transverse impression; the prothorax has the sides rounded and crenulated; the disc has a slight transverse impression near the front margin, and with a lens is seen, as well as the head, to be finely punctured. The elytra are dark green with a slight coppery tinge; they are rather strongly and irregularly punctured, some of the punctures being arranged so as to leave four irregular impunctate striæ on each elytron; the legs are black; the femora are not dentate beneath near the tip, but the anterior and posterior pairs are sinuated in that part. The anterior tibiæ have an angulated tubercle near the tip within, and the hind tibiæ are curved and sinuated before and beyond the middle on the inside.

My specimen of this insect is labelled Brazil, but it so completely agrees in its generic characters with the preceding, that there must have been some error.

Species 3.—The *Tenebrio cyaneus* of Fabricius (Ent. Syst. iv. 439), from Senegal, evidently belongs to the genus *Odontopus*; indeed Silbermann (and Chevrolat) and Laporte mention it as the third species, whilst Dejean gives it under the name of *Pezodontus speciosus*, or the *Lagria speciosa* of his former catalogue, giving the name of *cyaneus* as of Chevrolat, and as a synonym of his own name. Fabricius however describes it as having the elytra punctato-striate, and the "femora mutica;" the elytra are however covered with punctures, some of which alone, especially on the back, are disposed in striæ, and in all the specimens I have seen, the femora have two minute teeth near the tip beneath. Silbermann, however, describes them as only "munies d'*une* dent aiguë au sommet intérieur." The tibiæ in this species are compressed and all are slightly incurved, the tip being narrower than the middle of the limb. The margin of the thorax is entire. Mr. Hope possesses many specimens of a variety in which the elytra, instead of being of a fine coppery purple, are of a brassy colour. Fabricius, in the 'Systema Eleutheratorum,' i. p. 157, refers his *Helops metallicus* to his previously described *Tenebrio cyaneus*; but he appears to have evidently had two distinct insects in view at different times, the first from Senegal, in the collection of Paykull, and the second (*metallicus*) from South America, in the collection of Lund. The elytra in the latter are described as "obscuro-æneis" instead of "cupreis," as they are in the former.

Mr. Hope (Col. Man. iii. 74) gives the *Helops metallicus* as from Senegal, and as belonging to the genus *Præugena* of Laporte, but Laporte gives the Senegal insect under the genus *Odontopus*.

METALLONOTUS, G. R. Gray.

This is another tropical African form which comes very close to *Odontopus*, especially in the dilated form of the elytra, the denticulated margins of the prothorax and the metallic colouring; it differs, however, in having the 8th, 9th and 10th joints of the antennæ rather longer than the preceding and of equal size, and the 11th larger and longer, with the apex oblique; the prothorax is channeled down the middle; the elytra are considerably broader and more gibbose than in *Odontopus*; the femora are simple; the tibiæ long and rather slender, bent in the middle, and with the tips rather incurved. The type, *Metallonotus denticollis*, Gray (in Griff. An. K. Ins. pl. 80. fig. 4; called *Lagria gibbosus* in pl. 74. fig. 4, and in part xxxiv. p. 789, and *Lagria metallonotus* in part xxxi. p. 34), inhabits Sierra Leone; the head, thorax and legs are of shining green, and the elytra golden green with irregular punctures, misrepresented by the engraver of my drawing in plate 80 as arranged in striæ. The unique specimen is in the collection of Mr. Hope.

PRÆUGENA, Laporte, Hist. Nat. Ins. Col.

This new genus is characterized by its filiform antennæ, with the last joint evidently longer than the preceding, the body oval, slightly depressed and rather elongated, the thorax transverse with the sides rounded, the elytra rather broad at the base and gradually narrowed to the tip. It is composed of tropical African species, namely:—

Præugena rubripes, Laporte: Senegal.

Pr. carbonaria (*Helops carb.*, Klug, Ins. in Erman's Reise, p. 40. no. 119).

Pr. marginata (*Helops marg.*, Fabr. Ent. Syst. i. 118, and Syst. El. i. 157, and Klug in Erman's Reise, p. 40, no. 117.), Guinea, according to Fabricius.

Obs.—*Helops marginatus*, Fabr. Ent. Syst. iv. 440, is a distinct species; its name was accordingly altered by Fabricius in Syst. El. i. 161. to *H. striatus*, an equally unfortunate name, which has been applied to three other species of *Helops*, namely to *Helops violaceus*, F., given by Olivier and Herbst as *Tenebrio striatus*; to *Helops caraboides*, Pz. (nec Linn., Fab.) by Olivier as *Helops striatus*; and to the *Helops gibbulus* of Schönherr by Fourcroy. The Fabrician *marginatus* or *striatus* is said to be a native of the Cape of Good Hope in the 'Ent. Syst.,' but Mr. Hope (Col. Man. iii. p. 75) gives it as a native of Guinea, and as belonging to the genus *Eurynotus* of Kirby.

Mr. Hope also gives the *Helops quadripustulatus* (Fabr. Syst. El. i. 158), which is a native of Guinea, as a *Præugena*.

The following are the remaining species of *Tenebrio* and *Helops*, described, from tropical Western Africa, by Fabricius, which have not been noticed in the preceding observations:

Helops variegatus, Fab. Ent. Syst. i. 112, Syst. El. i. p. 158, described from the

Banksian cabinet as an inhabitant of Equinoctial Africa, is given by Mr. Hope (Col. Man. iii. 74) as a species of *Helops*.

Helops cyanipes, Fab. Syst. El. i. 158, described from Sehestedt's cabinet as a native of Guinea, is given by Mr. Hope (Col. Man. iii. 76) as a species of *Amarygmus*.

Helops dentatus, Fab. Syst. El. i. p. 160, described from Lund's cabinet as a native of Guinea, is given by Mr. Hope (Col. Man. p. 75) as a doubtful species of *Opatrinus*, whilst at p. 136 he states that M. Westermann assured him that it was the type of a new genus, closely allied to *Nyctobates*, but distinct. The Fabrician description is too slight to enable us to decide the species, but the dentate anterior tibiæ are especially mentioned.

Helops sinuatus, Fab. Syst. El. i. p. 160, described from Sehestedt's collection, is closely allied to, if not identical with, my *Nyctobates confusus*.

Helops longipes, Fab., is the type of Dejean's genus *Eupezus*, which comprises several species.

Helops striatus, Fab., is given by Mr. Hope as a native of Guinea (Col. Man. iii. p. 75), but Fabricius states the Cape of Good Hope to be its locality: see Ent. Syst. App. vol. iv. p. 440, where it was first described under the name of *H. marginatus*, which name was changed in consequence of Fabricius having described another African species under that name.

Tenebrio chalybæus (Linn. Syst. Nat. ii. 674, and Fabr. Ent. Syst. i. p. 111) is referred by Fabricius (Syst. Eleuth. i. p. 156) to *Helops cæruleus*, with the observation "vix differt." Linnæus however (who as well as Fabricius gives it as a native of Guinea) observes, "statura omnino *T. molitoris*, colore tantum diversum," which renders the correctness of the subsequent Fabrician reference of it to *cæruleus* as doubtful.

Genus Calostega, genus novum.

Corpus magnum, oblongum. *Caput* mediocre, clypeo margine antico recto, angulis anticis valdè productis, basin labri recipientibus. *Antennæ* crassæ, breves, articulis 7—10 præcedentibus majoribus, ultimo majori, apice subacuto. *Mandibulæ* ad apicem bidentatæ denteque altero majori in vel versus medium marginis interni armatæ. *Maxillæ* lobo interno in dentem corneum obtusum hamatum terminato. *Palpi maxillares* articulo ultimo securiformi. *Mentum* latum, lateribus rotundatis, basi valde constrictum. *Labium* quadratum. *Palpi labiales* articulo ultimo ovali. *Prothorax* subquadratus, antice paullo latior, lateribus versus angulos anticos serratis. *Elytra* oblongo-ovalia, lævia, metalli-colorata. *Pedes* crassi, femoribus omnibus ante apicem bispinosis; tibiis omnibus intus ante et pone medium sinuatis.

This type of form seems to be intermediate between *Pycnocerus* and *Odontopus*, whilst in the structure of its trophi it more resembles the species of the second section of *Prioscelis*. I think it not improbable, when we obtain a perfect knowledge of all the large African species of these insects, that it will be found necessary to sink some of the generic groups admitted in this paper. Our present knowledge does not, however, warrant our uniting the type of this group with any of the others.

CALOSTEGA PURPURIPENNIS. Species unica.

Tab. XV. Fig. 1.

Cal. nigra, subopaca, lævis; elytris purpureis, sub lente tenuissime striato-punctatis.

Long. corp. lin. 17; lat. elytr. fere lin. 6.

Hab. in Ashantee. Mus. D. Hope.

The general colour of the insect on the upper side is black, with a silky kind of gloss produced by the subopake surface, in which, with a very high-powered lens, are to be seen numerous minute shining punctures; the clypeus is broad and elevated, being separated from the vertex by a deep curved line, terminating in two deep lateral impressions; immediately behind each eye is a short deep impression, cutting the elevated space in two. The antennæ are black and shining, the terminal joints opake. The prothorax is rather broadest in front; the anterior angles are rather rounded off, behind which the margins are serrated; the posterior margin is more strongly margined than the lateral one; the disc is marked with two circular impressions towards the anterior margin, and two less distinct ones towards the hinder angles. The elytra are smooth and slightly shining, of a dark rich purple colour, and, with a strong lens, several rows of very minute punctures are to be observed; the humeral angles are rounded off; the legs are black and shining, as is the underside of the body.

NYCTOBATES, Guérin.

This genus has been characterized by M. Guérin (in the Magasin de Zoologie, class ix. pl. 118.) simply by the exserted and rounded labrum, the antennæ gradually thickening to the tip, with the terminal joints very compressed, and the general form of the insect, in all which respects it differs from the true *Tenebriones*. The *T. gigas* of Fabricius is given as its type; and in that South American insect, as well as in the Indian species, *N. tibialis*, we find the legs greatly elongated, with the tibiæ curved. As these characters apply to the following species, I give them as species of the same genus, although I think it probable that, upon a revision of the family, it will be necessary to separate them, and probably *N. tibialis*, from the South American species.

NYCTOBATES MŒRENS.

Tab. XV. Fig. 4.

Nyct. niger, subnitidus; capite thoraceque sub lente tenuissime punctatis, elytrisque tenuissime striato-punctatis; pedibus longis; tibiis subincurvis; thoracis angulis posticis acutis.

Long. corp. lin. $8\frac{1}{2}$; lat. elytr. pone medium, lin. $3\frac{3}{4}$.

Hab. in Guinea. In mus. nostr. Commun. D. Raddon.

Totus niger, parum nitidus. Caput margine antico (clypeo incluso) subsemicirculari, clypeo utrinque incisione parva in linea obliqua impressa desinente distinguendo; lineaque altera impressa longitudinali utrinque ad marginem internum oculorum. Superficies capitis regulariter punctata, punctis parvis; antennæ articulo primo crasso longitudine 4ti, 2do minuto, 3tio longo, cæteris longitudine fere æqualibus at sensim latioribus, 5 ultimis compressis setosis, ultimo ovali, basi truncato, apice rotundato: mandibulæ subtrigonæ, apice acutæ, intus edentatæ, sed spatio mediano membranaceo instructo. Maxillæ lobo interno in uncum corneum terminato; palpi maxillares articulo ultimo securiformi; mentum subquadratum, antice paullo latius, et carina curvata instructum; labium breve, transversum, ciliatum; palpi labiales breves, articulo ultimo dilatato-ovali, apice truncato. Prothorax capite multo latior, margine antico truncato, lateribus rotundatis, angulis posticis acutis; marginatus, margine tamen in medio marginis antici obliterato; superficies tota crebre punctata, punctis minutis et non approximatis. Elytra basi thorace latiora, humeris rotundatis; sensim latiora, apice utrinque parum sinuata; dorso gibboso; superficies sub lente quasi coriacea; singulis striis 9 e punctis minutis formatis, oculo nudo vix conspicuis, stria interna prope scutellum abbreviata. Pedes longi, graciles, femoribus anticis crassioribus; omnibus apice inermibus; tibiis anticis pone medium parum intus curvatis, apice externe intus setoso, extus oblique truncato, tibiis 4 posticis subrectis, medio vix subincurvato, apiceque subinflexis; calcaribus omnibus minutissimis.

Nyctobates lævigatus.

Fabricius, in the 'Entomologia Systematica,' vol. i. p. 111, gives the following short character of *Tenebrio lævigatus*: "T. oblongus ater, elytris læviusculis, *T. molitori* paullo minor, totus ater lævis glaber: habitat in Africa æquinoctiali; Mus. Dom. Banks." observing in the 'Systema Eleutheratorum,' "Species indistincta mihi haud rite nota," p. 146. In these two works there is no reference to Linnæus, although in his earlier publications (Sp. Ins. i. 323, and Mant. Ins. i. 211) he seems to have taken up the species from the 'Systema Naturæ' (vol. ii. p. 678), in which last work we find the following character given of *T. lævigatus*: "Apterus, niger, lævis, elytris lævibus, thorace lunato, subtus cæruleus; statura et summa similitudo *T. rugosi* [which has the "statura fere *Chrysomelæ* sed major"] sed elytra lævia," and with the habitat Africa.

The *Tenebrio lævigatus* of Linnæus is however a species of *Timarcha*, as cited by Schönherr[1] (Syn. Ins., vol. i. pt. 2. p. 239), and is supposed by the last-mentioned author to be identical with *Timarcha tenebricosa*. The *Tenebrio lævigatus* of Olivier is still a different insect. Mr. Hope gives the *T. lævigatus*, Fabr., as a species of *Upis* (Coleopt. Man. iii. p. 130). His observation is derived from an insect in the Banksian

[1] Schönherr has erroneously referred to this insect under the name of *Chrysomela lævigata* of Linnæus, who, however, has described no species of *Chrysomela* under that name.

cabinet to which the name of *Tenebrio lævigatus* is attached; but it is very questionable whether that insect was the one observed by Fabricius, as he expressly says that it is smaller than *Tenebrio molitor*, whereas the Banksian insect greatly exceeds that species in size. I therefore do not hesitate to consider it as not identical with the specimen so concisely described by Fabricius, and therefore now describe and figure it under the name of

Nyctobates confusus.

Tab. XV. Figs. 6 and 7.

Nyct. niger lævis subnitidus; elytris latioribus, pronoti lateribus in medio sinuatis et sanguineo-marginatis.

Long. corp. unc. 1; lat. elytr. pone med. lin. 5.

Hab. in Africa æquinoctiali. In mus. Soc. Linn. Lond. olim D. Banks.

Caput nigrum, sub lente tenuissime punctatum, carina longitudinali utrinque versus marginem internum oculorum. Antennæ articulis apicalibus latioribus. Pronotum transverse quadratum, angulis anticis oblique truncatis et parum rotundatis, lateribus in medio sinuatis, tenuissime marginatis, angulis posticis acutis fere rectangulis; sub lente tenuissime punctatum; lateribus late et obscure sanguineis, colore sanguineo ante medium, intus acute producto, dorso nigro: margine postico in medio versus scutellum producto. Elytra nigra nitida lævia, latiora quam in congenericis, præsertim pone medium, apicem versus attenuata; sub lente seriebus 8 longitudinalibus punctorum minutorum. Pedes longitudine mediocres, graciles, tibiis simplicibus fere rectis.

Individuum in mus. D. Hope vidi lineas 9½ tantum habens staturaque parum minus robusta, vix tamen species distincta. Tab. XV. Fig. 7.

Nyctobates punctatus.

Tab. XV. Fig. 10.

Nyct. niger obscurus; prothoracis angulis anticis rotundatis, lateribus in medio incisis angulisque posticis acutis; elytris punctato-striatis; antennis sensim dilatatis.

Long. corp. lin. 9¾; lat. elytr. pone med. fere lin. 4.

Hab. in Guinea. In mus. Dom. Hope. Comm. D. Westermann.

Syn. Helops punctatus, *Fabr. Syst. Eleuth.* i. 161.

I give the insect here described as the true *H. punctatus*, Fab., on the authority of a specimen received by the Rev. F. W. Hope from Copenhagen, from M. Westermann (who has such excellent opportunities of determining those Fabrician species which were described from the cabinets of Lund and Sehestedt, as was the case with the present species). This is the more important, as the Fabrician description is so slight as to be applicable to scores of species of Heteromerous insects. The following is a more detailed description:—

Caput obscurum sub lente tenue punctatum, clypeo postice impressione transversa e vertice separato, carinaque utrinque ad marginem oculorum. Antennæ mediocres sensim ad apicem incrassatæ compressæ, linea tenui media impressa postica. Prothorax subquadratus, angulis anticis rotundatis, lateribus in medio sinuatis, tenue marginatis, angulis posticis acutis et parum extus productis; margine postico versus scutellum postice producto. Elytra thorace haud multo latiora, pone medium parum latiora, singulo seriebus 8 longitudinalibus punctorum impressorum magnitudine irregularium, striaque altera abbreviata versus scutellum; striis 1 et 2 ad basin connexis; striæ 5 et 6 longe ante apicem conjunguntur; striæ 3 et 4 propiores, 2da cum 7ma et 1ma cum 8va connexis. Pedes longitudine mediocres, tibiis simplicibus et fere rectis. Mesosternum antice bidentatum, prosterni apicem acutum recipiens.

NYCTOBATES HYPOCRITA.

Tab. XV. Fig. 9.

Nyct. niger subobscurus, tenuissime punctatus; prothoracis lateribus subrotundatis integris, angulis anticis acutis; antennis longioribus, apicibus parum latioribus.

Long. corp. lin. $8\frac{3}{4}$; lat. elytr. pone med. lin. $3\frac{1}{2}$.

Hab. in Guinea. In mus. Dom. Hope. Comm. Dom. Westermann.

Syn. Ipthinus Hypocrita, *Dej. Cat.*, sine descr.

Ipthinus Guineensis, *Westermann, MSS.*

Niger subobscurus. Caput (præsertim in clypeo) et prothorax punctata; clypeus e vertice linea impressa curvata vix separata, carina utrinque parum elevata ad marginem internum oculorum. Antennæ graciles, articulis 3 vel 4 ultimis parum latioribus compressis. Prothorax subquadratus, lateribus subrotundatis marginatis integris, angulis posticis acutis; margine postico fere recto, tenue marginato. Elytra parum convexiora quam in reliquis; singulo sulcis 8 profundis longitudinalibus et punctatis; inter se connexis ut in specie præcedenti; pone medium paullo latiora et postice acuminata. Pedes longiores, simplices, tibiis parum curvatis.

NYCTOBATES TRANSVERSALIS.

Tab. XV. Fig. 8.

Nyct. niger subobscurus, subpunctatus; capite parvo; oculis magnis; antennis apice haud incrassatis; prothorace transverso, angulis anticis rotundatis, lateribus integris; elytris striato-punctatis.

Long. corp. lin. $9\frac{1}{2}$; lat. elytr. lin. 4.

Hab. apud Sierram Leonam. In mus. Dom. Hope et Waterhouse.

Caput sub lente punctatum, præsertim in clypeo magno transverso-ovato, e vertice linea forti impressa semicirculari separato; oculi magni, angulis internis intus productis; spatio parvo intermedio tantum relicto; carinæ duæ interoculares subobsoletæ.

Antennæ breves subdepressæ; articulis 7 ultimis subæqualibus, haud apicem versus incrassatis. Prothorax latior quam longus, lateribus tenue marginatis subrotundatis integris, angulis posticis vix acutis; margine postico fere recto; dorso tenue punctato. Elytra fere parallela; thorace latiora, angulis humeralibus oblique truncatis, longitudinaliter sulcatis, sulcis sub lente punctatis, striaque altera abbreviata versus scutellum. Pedes graciles simplices, tibiis fere rectis.

Nyctobates brevicornis.

Tab. XV. Fig. 11.

Nyct. niger; capite et pronoto tenuissime punctatis; antennis brevibus; prothorace quadrato, lateribus parallelis; elytris punctato-striatis; pedibus brevibus.

Long. corp. lin. 11; lat. lin. $4\frac{1}{4}$.

Hab. ——? In mus. Dom. Hope.

Caput sub lente tenuissime punctatum, clypeo e vertice vix separato, carinisque interocularibus obsoletis. Oculi margine interno rotundato. Antennæ vix capite longiores, articulis 6 apicalibus compressis subæqualibus. Prothorax quadratus, lateribus fere rectis et parallelis, angulis anticis rotundatis, posticis vero acutis, margine postico in medio paullo rotundato-producto; disco tenuissime punctato, linea tenuissima punctorum in medio. Elytra subparallela, elongata, prothorace parum latiora, singulo seriebus 8 punctorum profunde impressorum, striaque basali interrupta punctata versus scutellum. Pedes breves, simplices, tibiis fere rectis.

Nyctobates rotundicollis.

Tab. XV. Fig. 5.

Nyct. niger, subopacus; capite pone oculos utrinque sulcato; thorace rotundato, varioloso-punctato; elytris profunde punctato-striatis.

Long. corp. lin. 7; lat. lin. $2\frac{3}{4}$.

Hab. apud Sierram Leonam. In mus. Dom. Hope et Waterhouse.

Caput punctatum; clypeo magno e vertice impressione arcuato separato. Oculi majores carinis interocularibus obsoletis, sulco utrinque ex angulo interno oculorum ad prothoracem ducto. Antennæ breves, articulis 6 ultimis majoribus subæqualibus subtriangularibus latis depressis, ultimo majori. Prothorax rotundatus, lateribus rotundatis, angulis posticis subobtusis; disco varioloso punctatissimo; margine postico magis marginato quam lateres et in medio versus scutellum parum rotundato. Elytra lateribus fere parallelis, angulis humeralibus rotundatis, singulo striis 9 punctorum profunde impressorum, striis 4 et 5, 3 et 6, 7 et 8, 2 et 9 ad apicem conjunctis. Pedes breves, simplices, tibiis rectis; femoribus anticis crassioribus.

I shall terminate this memoir with the descriptions of three other insects from tropical Africa, nearly allied to some of the preceding in the structure of the mouth, but differing from them and from all known Heteromerous beetles in their generic characters.

Genus Nesioticus, genus novum.

Corpus breve, rotundatum, valde gibbosum. *Caput* mediocre, breve, margine antico (clypeo) et lateribus (ante oculos) elevatis, vertice parum concavo. *Labrum* breve transversum, angulis anticis rotundatis, ciliatum. *Mandibulæ* trigonæ crassæ, extus rotundatæ, intus sinuatæ, cavitate parva in medio. *Maxillæ* lobo externo majori, subarticulato, valde setoso; interno setoso inermi. *Palpi maxillares* crassi, articulo ultimo maximo securiformi. *Mentum* oblongum, antice paullo latius, angulis anticis acute productis. *Labrum* subquadratum, angulis anticis rotundatis, setosum. *Palpi maxillares* breves, articulo ultimo ovato, apice subtruncato. *Antennæ* prothorace fere longitudine æquales, articulo basali detecto, 3tio, 4to duplo longiori, hoc et sequentibus ad 10um latitudine parum crescentibus compressis, longitudine æqualibus, articulo 11mo præcedenti parum longiori, subrotundato. *Prothorax* transversus, antice angustiori, lateribus subrotundatis, angulis posticis acutis. *Scutellum* triangulare *Elytra* valde convexa, ovali-rotundata, thorace fere duplo latiora. *Pedes* simplices, longitudine fere æquales, tibiis rectis, tarsis subtus setosis, unguibus acutis. *Mesosternum* obtusum, paullo porrectum. *Venter* 5-annulatus.

Nesioticus flavo-pictus.

Tab. XV. Fig. 13.

Nes. niger, nitidus, lævis; elytrorum humeris apicibusque signaturis flavo-notatis.

Long. corp. lin. 8; lat. elytr. lin. $4\frac{1}{2}$.

Hab. (Gold Coast), Africæ tropicæ. Mus. Westw. Comm. Dom. Raddon.

Niger, nitidus, lævis, sub lente haud punctatus, capite excepto. Labrum piceum. Antennæ nigræ, articulo ultimo apice brunneo. Vertex tenuissime punctatus. Thorax lateribus tenuissime marginatis. Elytra valde convexa, nitida, singulo lineis 8 punctorum minutorum impresso; fascia tenui, transversa, flava, versus basin ad suturam interrupta, et cum striga marginali, alteraque media longitudinali ad basin elytrorum extensa connexa; singulo elytro etiam versus apicem signatura tenui, subtriangulari, ejusdem coloris notato.

Genus Ogcoosoma, genus novum.

Corpus breve latissimum. *Caput* mediocre, carina utrinque e margine antico et interno oculorum fere ad basin mandibularum ducta. *Antennæ* longitudine capitis et prothoracis, graciles versus apicem vix crassiores, articulo 3tio longissimo, 4to et reliquis subæqualibus setosis. *Mandibulæ* crassæ, extus rotundatæ, apice subbifidæ, margine interno fere recto. *Labrum* transversum, emarginatum. *Mandi-*

bulæ lobis duobus membranaceis ciliatis; *palpi maxillares* articulo ultimo magno, securiformi. *Mentum* obconicum, basi truncatum et angustatum, angulis anticis acutis, in medio longitudinaliter carinatum. *Labium* cordatum. *Palpi labiales* articulo ultimo majori, ovali, apice acuminato. *Prothorax* latior quam longus, convexus, lateribus in medio rotundato-angulatis, angulis anticis et posticis acutis. *Elytra* prothorace multo latiora, convexa, rotundata, interrupto-costata. *Pedes* mediocres, graciles, setigeri.

Ogcoosoma granularis. Species unica.

Tab. XV. Fig. 14.

Ogc. nigrum sericeum; prothorace punctis duobus rotundatis discoidalibus; elytris irregulariter et interrupto-costatis; antennis pedibusque cinereo-setosis.

Long. corp. lin. 6; lat. elytr. lin. 4.

Hab. in Gambia. In mus. Westwood.

Caput et thorax nigra, sericea (sc. sub lente), tuberculis minutissimis alterisque majoribus sparsis nitidis obsita, hoc lateribus sub medio angulato-rotundatis, marginatis. Elytra nigra et magis nitida, minutissime granulata, tuberculisque numerosis majoribus elongatis et irregularibus, costas duas in singulo elytro quodammodo formantibus; lateribus marginatis et deflexis, latera abdominis cingentibus. Pedes sat breves graciles, tibiis posticis parum curvatis.

Genus Megacantha, genus novum.

Corpus robustum, crassum, convexum. *Caput* breve punctatum, lateribus ante oculos elevato-tuberculatis. *Oculi* reniformes. *Labrum* transversum, angulis anticis rotundatis. *Mandibulæ* crassæ, apice parum bidentatæ. *Maxillæ* lobo interno membranaceo, externo magno, valde setigero. *Palpi maxillares* articulo ultimo securiformi. *Mentum* crateriforme. *Labium* cordatum. *Palpi labiales* breves, articulo ultimo crasso, ovali, apice subtruncato. *Antennæ* sat longæ, articulo 3tio vix 4to longiori, 7mo cæteris parum crassiori, hoc et reliquis præcedentibus paullo latioribus. *Prothorax* rotundatus, antice et postice subtruncatus, capite multo latior. *Elytra* brevia, oblongo-ovalia, thorace latiora, convexa, punctato-striata. *Pedes* satis elongati, femoribus anticis crassis, ante apicem interne dento valido curvato armatis. *Tibiæ* anticæ ante medium extus paullo curvatæ; intermediæ intus subserratæ; posticæ rectæ.

Fœmina differt capite et prothorace paullo minoribus, hoc minus rotundato, pedibus anticis brevioribus et gracilioribus, dente femorum anticorum multo minori, tibiis anticis minus curvatis, tibiisque intermediis haud serrulatis.

Megacantha tenebrosa.

Tab. XV. Fig. 12.

Meg. nigra, subnitida, punctata; elytris striato-punctatis; angulis humeralibus distinctis.

Long. corp. lin. $9\frac{1}{2}$—$10\frac{1}{2}$; lat. elytr. lin. $4\frac{3}{4}$.

Hab. Ashantee. In Mus. Dom. Hope.

Caput nigrum, punctatum; clypeus brevis, vix e vertice separatus. Oculi intus subapproximati, lunula tenui, lævi, subnitida et subelevata interjecta; tuberculi anteoculares magni, basin antennarum tegentes. Prothorax tenue punctatissimus, lateribus rotundatis, angulis anticis acutis, posticis subacutis. Elytra sat profunde 8-punctato-striata; striaque altera valde abbreviata versus scutellum, striis 4 et 5 3 et 6, et 2 et 7 postice conjunctis. Pedes et corpus infra nigra, subnitida.

An *Helops dentatus*, Fab.?

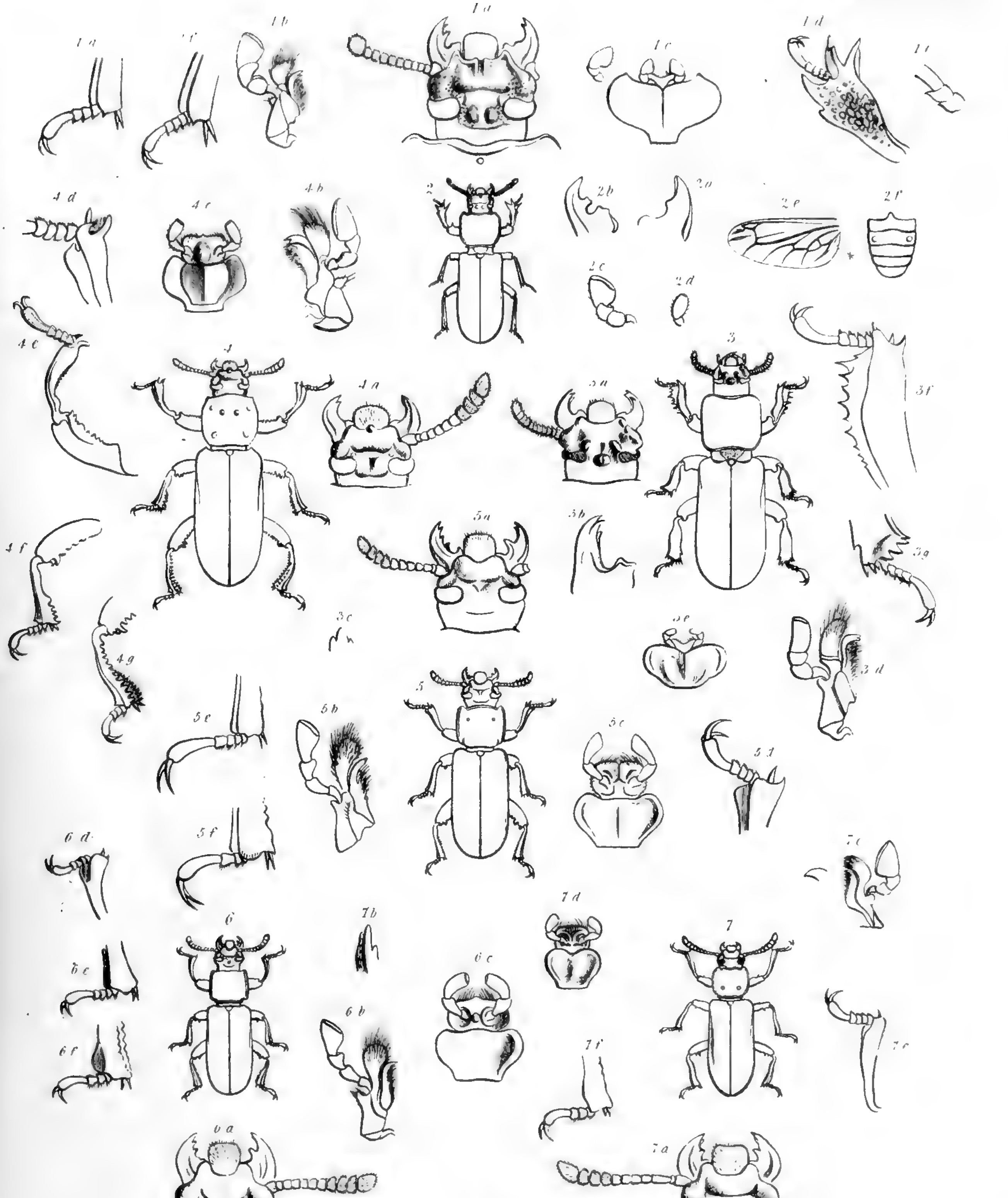
DESCRIPTION OF THE PLATES.

PLATE XIV.

Fig. 1 *a*—1 *g*. Details of *Chiroscelis digitata*, Westw.
2. Chiroscelis bifenestrella, *W.*
3. Chiroscelis Passaloides, *W.*
4. Prioscelis Fabricii, *Hope.*
5. Prioscelis (Iphius) serrata, *Hope.*
6. Prioscelis (Iphius) Raddoni, *W.*
7. Prioscelis (Iphius) crassicornis, *W.*

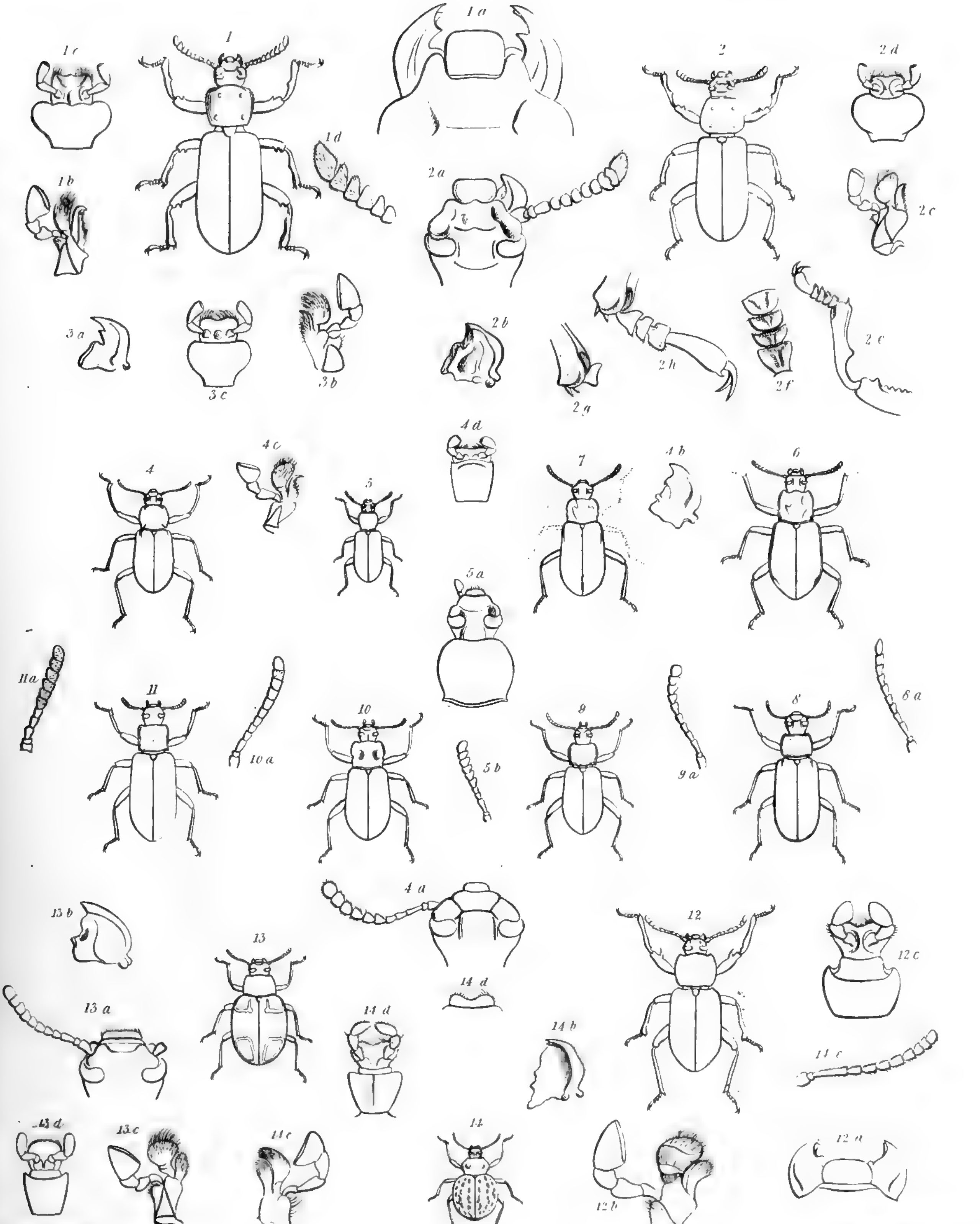
PLATE XV.

Fig. 1. Calostega purpuripennis, *W.*
2. Pycnocerus Westermanni, *Hope.*
3. Odontopus cupreus, *Fabr.*
4. Nyctobates mœrens, *W.*
5. Nyctobates rotundicollis, *W.*
6. Nyctobates confusus, *W.*
7. Ditto (varietas angustior).
8. Nyctobates transversalis, *W.*
9. Nyctobates Hypocrita, *Dej.*
10. Nyctobates punctatus, *Fabr.*
11. Nyctobates brevicornis, *W.*
12. Megacantha tenebrosa, *W.*
13. Nesioticus flavo-pictus, *W.*
14. Ogcoosoma granularis, *W.*



J.O. Westwood, del.

1. Chiroscelis digitata ... 5. Pr. serrata



Day & Haghe lith.rs to the Queen

1. Calostega purpuripennis. 2. Pycnocerus Westermanni 3. Odontopus Cupreus. 4. Nyctobates maxers
5. N. rotundicollis. 6. N. confusus. 7. Ditto (varietas angustior) 8. N. Transversalis 9. N. Hypocrita
10. N. Punctatus 11. N. brevicornis. 12. Megacantha tenebrosa. 13. Nesioticus flavo pictus
14. Ogcocosoma granularis.

IX. *Mémoire sur la Famille des* Touracos, *et Déscription de deux Espèces nouvelles. Par le* Dr. Eduard Rüppell.

Communicated January 11, 1842.

Un des groupes les mieux limités parmi l'innombrable classe des oiseaux est celui des *Touracos.* Le rapport naturel des trois genres qui le composent est si saillant, les caractères des espèces si nets, que les naturalistes n'ont jamais été en difficulté à les admettre et à les avoisiner. La patrie de cet groupe est limitée exclusivement à cette partie de l'Afrique qui s'étend au sud du 15^{me} degré de latitude boréale. En publiant il y a six ans, dans ma faune Abyssinienne les deux belles espèces, que j'avais découvertes dans ce royaume, j'avais donné (page 7 de la section des oiseaux) un aperçu de toutes les espèces de ce groupe connues à cette époque; leur nombre total n'était que de neuf, savoir:

5 Corythaix,
3 Musophaga,
et 2 Chizaerhis.

Depuis ce temps là, l'infatigable Dr. Andrew Smith a publié une nouvelle espèce, le *Chizaerhis concolor*[1], et a donné une belle figure du *Corythaix porphyreolopha*, Vigors[2], dont on n'avait pas encore de représentation iconographique. Sir William Jardine a publié de plus la figure du *Corythaix Buffonii*[3], qui ne laisse rien à désirer.

J'ai aujourd'hui l'avantage de communiquer les figures et les déscriptions de deux superbes espèces nouvelles de *Chizaerhis*, qui m'ont été envoyées il y a peu de temps par un de mes chasseurs Européens, que j'ai envoyé il y a plus de six ans en Abyssinie, pour continuer à explorer les innombrables productions, dont la nature s'est plue d'animer les sîtes pittoresques de ces provinces. C'est dans les gorges solitaires, qui séparent la province de Godjam du royaume de Shoa, et dans les vallées de ce dernier royaume, parmi ces arbres gigantesques, qui tapissent les flancs des vallons du Nil et de ses affluants, que mon chasseur eut le bonheur d'attrapper ces nouvelles espèces. Je ne sais si la necessité de se limiter au moins de baggage possible l'ait obligée de ne tuer qu'un seul couple de l'une espèce et trois individus de l'autre, ou qu'effectivement il ne parvint à attrapper que ce nombre. En effet, il n'en envoya que ces cinq individus, dont je me suis empressé de déposer quatre dans les galeries du Musée de notre ville.

[1] Illustrations of the Zoology of South Africa, Aves, plate 2.
[2] Ibidem, Aves, plate 35.
[3] Illustrations of Ornithology, plate 122.

Je fais mention de cette circonstance très spécialement, pour être excusé si je n'accompagne pas ce mémoire des dépouilles mêmes des objets décrits: et c'est par la même circonstance que j'ai préferé d'envoyer ces déscriptions et figures à Londres à la Société Zoologique, ce qui contribuera bien mieux à faire connoitre ces beaux oiseaux, que si je les avais publiés dans quelqu' écrit périodique du Continent.

Chizaerhis personata, Rüppell.

Tab. XVI.

Diagnosis.—Chizaerhis regione ophthalmica, genis, mento, et gula, pennis denudatis, cute nigricante, vibrissis brevissimis vestita; pileo crista plicatili plumis laxis elongatis colore murino; nucha, regione parotica, juguloque albidis, jugulo et pectore viridi-glaucis, abdomine et tibiis rufo-cervinis; auchenio, dorso et alis cæsio-umbrinis, rectricibus olivaceis; cauda elongata, subrotundata, supra cinerea, infra luteo-virente; rostro et pedibus nigris; iride albo-cinerascente.

La particularité la plus caractéristique de cette espèce est le dénûment de plumes de la face et de la gorge, où la peau n'est couverte que de petits poils clair-semés; cette peau paroit être de couleur pourpré noirâtre. Les plumes du front et du sinciput sont allongées, à barbes molles et flottantes; elles doivent être érectiles, et former une houpe à la volonté de l'oiseau. Les deux sexes se ressemblent absolument en plumage et en taille. Leur dimensions, exprimées en pied de Paris, sont:—

	Pied.	Pouce.	Ligne.
Longueur totale depuis la pointe du bec, jusqu'au bord terminal des rectrices	1	7	0
La queue mesure séparément	0	10	0
Longueur du bec mesuré selon sa courbure supérieure	0	1	1
Plus grande dimension verticale des deux mandibules	0	0	$7\frac{1}{2}$
Longueur de l'aile depuis sa flexure jusqu'à l'extremité de la 4me rémige, qui est la plus longue	0	8	0
Longueur du tarse	0	1	6
Longueur du doigt du milieu, y compris l'ongle	0	1	10

Chizaerhis leucogaster, Rüppell.

Tab. XVII.

Diagnosis.—Chizaerhis pileo crista plicatili, plumis apice truncatis, capite, gutture, collo, cervice, dorso et alis ex cæsio-umbrinis, tectricibus medianis nigro-marginatis, remigibus dimidio basali albis, dimidio apicali umbrino-nigris; cauda subrotundata, supra et subtus nigra, fascia alba lata transversa, rectricibus duobus intermediis ex cæsio-umbrinis; abdomine et tibiis albis; rostro et pedibus nigricantibus, iride umbrina.

F.C.Vogel del

M&N Lithog

Chizaerhis personata. (Rüppell).
½ Nat Size

Chizaerhis leucogaster (Rüppell)
(½ Nat. Size)

Une chose très particulière à cette espèce, c'est que les plumes qui forment la houpe de la tête sont toutes tronquées à angle droit : même coloris et grandeur dans les deux sexes ; les spécialités des dimensions sont :—

	Pied.	Pouce.	Ligne.
Longueur totale	1	6	9
La queue séparément	0	9	9
Longueur du bec	0	0	$11\frac{1}{2}$
Sa plus grande hauteur verticale	0	0	$6\frac{1}{2}$
Longueur de l'aile jusqu'à la 5 rémige	1	7	9
Tarse	0	1	8
Doigt du milieu avec l'ongle	0	1	10

Dr. Eduard Rüppell.

Francfort-sur-Maine, le 28 Novembre 1841.

X. *On* Dinornis[1], *an extinct Genus of tridactyle Struthious Birds, with descriptions of portions of the Skeleton of five Species which formerly existed in New Zealand. By Professor* Owen, *M.D., F.R.S., Z.S., &c. &c.* (Part I.)

Communicated November 28th, 1843.

Introduction.

THE brief history of the discovery of the *Dinornis*, a genus of gigantic terrestrial birds, which appears to have become extinct within the historical period in the North Island of New Zealand, like the Dodo in the island of Mauritius, will be found in the Proceedings of the Zoological Society for November 1839, and in the Society's Transactions, vol. iii. p. 32, pl. 3. These papers contain the inferences deduced from the structure of the shaft of a femur, which led to the first announcement of the former existence in New Zealand of a large Struthious bird "of a heavier and more sluggish species than the Ostrich."

As the full development and confirmation of this idea is included in the following pages, I am induced, in vindication of the fruitful principle of physiological correlations, the value of which as an instrument in the interpretation of organic remains there has been a tendency to depreciate in an otherwise estimable osteological work[2], to premise the abstract of my former communication published four years ago:—

"The fragment is the shaft of a femur, with both extremities broken off. The length of the fragment is six inches, and its smallest circumference is five inches and a half. The exterior surface of the bone is not perfectly smooth, but is sculptured with very shallow reticulate indentations; it also presents several intermuscular ridges. One of these extends down the middle of the anterior surface of the shaft to about one-third from the lower end, where it bifurcates; two other ridges or lineæ asperæ traverse longitudinally the posterior concave side of the shaft; one of them is broad and rugged, the other is a mere linear rising.

"The texture of the bone, which affords the chief evidence of its ornithic character, presents an extremely dense exterior crust, varying from one to two lines in thickness; then there occurs a lamello-cellular structure of from two to three lines in thickness. The lamellæ rise vertically to the internal surface of the dense wall, are directed obliquely to the axis of the bone, decussate and intercept spaces which are generally of a rhomboidal form, and from two to three lines in diameter. This coarse cancellated structure is continued through the whole longitudinal extent of the fragment, and im-

[1] Δεινὸς, *surprising*, ὄρνις, *bird*.

[2] The 'Osteographie' of Prof. De Blainville.

mediately bounds the medullary cavity of the bone, which is about one inch in diameter at the middle, and slightly expands towards the extremities. There is no bone of similar size which presents a cancellous structure so closely resembling that of the present bone as does the femur of the Ostrich; but this structure is interrupted in the Ostrich at the middle of the shaft where the parietes of the medullary, or rather air-cavity, are smooth and unbroken. From this difference I conclude the Struthious bird indicated by the present fragment to have *been a heavier and more sluggish species than the Ostrich*; its femur, and probably its whole leg, was shorter and thicker. It is only in the Ostrich's femur that I have observed superficial reticulate impressions similar to those on the fragment in question. The Ostrich's femur is subcompressed, while the present fragment is cylindrical, approaching in this respect nearer to the femur of the Emeu; but its diameter is one-third greater than that of the largest Emeu's femur, with which I have compared it.

"The bones of the extremities of the great *Testudo elephantopus* are solid throughout. Those of the Crocodile have no cancellous structure like the present bone. The cancellous structure of the mammiferous long bones is of a much finer and more fibrous character than in the fossil.

"Although I speak of the bone under this term, it must be observed that it does not present the characters of a true fossil; it is by no means mineralized: it has probably been on, or in, the ground for some time, but still retains most of its animal matter. It weighs seven ounces twelve drachms, avoirdupois.

"The discovery of a relic of a large Struthious bird in New Zealand is one of peculiar interest, on account of the remarkable character of the existing Fauna of that Island, which still includes one of the most extraordinary and anomalous genera of the Struthious order, and because of the close analogy which the event indicated by the present relic offers to the extinction of the Dodo of the island of the Mauritius. So far as a judgement can be formed of a single fragment, it seems probable that the extinct bird of New Zealand, if it prove to be extinct, presented proportions more nearly resembling those of the *Dodo* than of any of the existing *Struthionidæ*.

"Any opinion, however, as to its specific form can only be conjectural: the femur of the Stilt-bird (*Himantopus*) would never have revealed the anomalous development of the other bones of the leg; but so far as my skill in interpreting an osseous fragment may be credited, I am willing to risk the reputation for it on the statement that there has existed, if there does not now exist, in New Zealand, a Struthious bird nearly, if not quite, equal in size to the Ostrich[1]."

The first letter received by me from New Zealand, confirming this announcement and acquainting me with the existence of the specimens described in the present communication, was written by my friend the Rev. Wm. Cotton, M.A., and has been already published in the Proceedings of the Society[2]. I now subjoin, by Dr. Buckland's permission, the

[1] Proc. Zool. Soc., November 12th, 1839.

[2] *Ibid.* January 10th, 1843.

letter[1] addressed to him by the Rev. Wm. Williams, a zealous and successful Church Missionary long resident in New Zealand, on the occasion of transmitting to Dr. Buck-

[1] "Poverty Bay, New Zealand, Feb. 28th, 1842.

"Dear Sir,—It is about three years ago, on paying a visit to this coast, south of the East Cape, that the Natives told me of some extraordinary monster which they said was in existence in an inaccessible cavern on the side of a hill near the river Wairoa; and they showed me at the same time some fragments of bone taken out of the beds of rivers, which they said belonged to this creature, to which they gave the name of 'Moa.' When I came to reside in this neighbourhood I heard the same story a little enlarged, for it was said that the creature was still existing at the said hill, of which the name is 'Wakapunake,' and that it is guarded by a reptile of the Lizard species, but I could not learn that any of the present generation had seen it. I still considered the whole as an idle fable, but offered a large reward to any one who would catch me the bird or its protector. At length a bone was brought from a river running at the foot of the hill, of large size, but the extremities were so much worn away that I could not determine anything as to its proper relationship. About two months ago a single bone of smaller size was brought from a freshwater stream in this bay, for which I gave a good payment, and this induced the natives to go in large numbers to turn up the mud at the banks and in the bed of the same river, and soon a large number of bones was brought, of various dimensions. On a comparison with the bones of a fowl, I immediately perceived that they belonged to a bird of a gigantic size. The bones of which the greatest number have been brought are the three bones of the leg, a few toe-bones, and one claw, which is one inch and a half in length, a few imperfect pelves, and a few vertebræ of different dimensions, and one imperfect cranium, which is small. There are also a few broken pieces, which seem to be ribs. In the case now sent you will receive the largest specimens I have obtained, and also a few of smaller size. The length of the large bone of the leg is two feet ten inches. I have a second case, which I shall send by another vessel, to make sure of your receiving them. If the bones are found to be of sufficient interest, I leave it to your judgement to make what use of them you think proper; but if the duplicates reach you, perhaps one set may with propriety be deposited in our museum at Oxford.

"The following observations may not be devoid of interest:—

"1st. None of these bones have been found on dry land, but are all of them from the bed and banks of fresh-water rivers, buried only a little distance in the mud; the largest number are from a small stream in Poverty Bay, Wairoa, and at many inconsiderable streams, and all these streams are in immediate connexion with hills of some altitude.

"2nd. This bird was in existence here at no very distant time, though not in the memory of any of the inhabitants, for the bones are found in the beds of the present streams, and do not appear to have been brought into their present situation by the action of any sudden rush of waters.

"3rd. That they existed in considerable numbers. I have received perfect and imperfect bones of thirty different birds.

"4th. It may be inferred that this bird was long-lived, and that it was many years before it attained its full size: out of a large number of bones, only one leg-bone now sent is of the size two feet ten inches; two others are two feet six inches, one of which I shall send hereafter. The rest are all of inconsiderable size.

"5th. The greatest height of the bird was probably not less than fourteen or sixteen feet. The leg-bones now sent give the height of six feet from the root of the tail. I am told that the name given by the Malays to the Peacock is the same as that given by the natives to this bird.

"Within the last few days I have obtained a piece of information worthy of notice. Happening to speak to an American about the bones, he told me that the bird is still in existence in the neighbourhood of Cloudy Bay, in Cook's Straits; he said that the natives there had mentioned to an Englishman of a whaling party that there was a bird of extraordinary size to be seen only at night on the side of a hill near there; and that he, with the native and a second Englishman, went to the spot; that after waiting some time they saw the creature at some little distance, which they describe as being fourteen or sixteen feet high. One of the men proposed to go nearer and shoot, but his companion was so exceedingly terrified, or perhaps both of them, that they were satis-land the instructive series of rare specimens with which the active spirit and enlightened liberality of their collector have enriched the scientific collections of his native land.

It will be seen from that letter that Mr. Williams had confirmed, by comparison with the bones of the common fowl, the traditional statement of the natives of New Zealand relative to the huge bones which they at different times brought to him, in regard to the class of animals to which they belonged; he has, therefore, a just claim to share in the honour of the discovery of the *Dinornis*, since, whilst collecting and comparing its osseous remains, he was wholly unaware that its more immediate affinities had already been determined in England.

By means of the specimens first transmitted by Mr. Williams to Dr. Buckland, and generously confided to me by that distinguished Geologist, I was enabled to define the generic characters of the *Dinornis*, as afforded by the bones of the hind extremity[1]: by the favour of a like disposition of Mr. Williams's second and richer collection of bones, and from three additional specimens confided to me, in the same liberal spirit, by Dr. Richardson of Haslar Hospital, evidence has been obtained of five distinct species of the genus, ascending respectively from the size of the Great Bustard to that of the Dodo, of the Emeu, of the Ostrich, and finally attaining a stature far surpassing that of the once-deemed most gigantic of birds.

I shall first enumerate the specimens of the bones which I have examined and compared, then proceed to point out their common generic characters, and finally their specific differences.

List of Bones of the *Dinornis* collected by the Rev. Wm. Williams in Poverty Bay, New Zealand, and transmitted to England.

Nos.
v 1. Middle cervical vertebra.
v 2. Posterior cervical vertebra.
v 3. Posterior cervical vertebra.
v 4. Anterior dorsal vertebra.
v 5. Middle dorsal vertebra.
p 1. Anterior part of pelvis.
p 2. Right os innominatum.
p 3. Fragment of os innominatum.

fied with looking at him, when in a little time he took the alarm and strode away up the side of the mountain. This incident might not have been worth mentioning, had it not been for the extraordinary agreement in point of size of the bird. Here are the bones, which will satisfy you that such a bird *has been*, and *there* is said to be the living bird, the supposed size of which, given by an independent witness, precisely agrees. Should I obtain anything more perfect you will not fail to hear from me, and in the meantime may I request the favour of your opinion on these bones, and also the information whether any others of similar character have been found elsewhere?

"I beg to remain, dear Sir, your obedient servant,

"*To Dr. Buckland, &c. &c.*" "WILLIAM WILLIAMS."

[1] Proceedings of the Zoological Society, January 10th, 1843.

Nos.		
p 4.	Pelvis, nearly entire.	
p 5.	Ditto, more fractured.	
f 1.	Shaft of femur,	right (one foot four inches long when entire).
f 2.	Femur,	right (one foot one inch long).
f 3.	Ditto,	right, extremities broken.
f 4.	Shaft of femur,	right.
f 5.	Femur,	right.
f 6.	Ditto,	right.
f 7.	Ditto,	right.
f 8.	Ditto,	right.
f 9.	Shaft of femur,	right.
f 10.	Ditto,	right.
f 11.	Ditto,	left.
f 12.	Femur,	left.
f 13.	Ditto,	left, extremities broken.
f 14.	Ditto,	left, ditto ditto.
f 15.	Shaft of femur,	left.
f 16.	Femur,	left.
f 17.	Ditto,	left.
f 18.	Shaft of femur,	left.
t 1.	Tibia,	left (two feet eleven inches long).
t 2.	Ditto,	left (two feet five inches long).
t 3.	Ditto,	left.
t 4.	Ditto,	left.
t 5.	Shaft of tibia,	left (part of).
t 6.	Ditto,	right.
t 7.	Ditto,	right (more broken).
t 8.	Tibia,	right.
t 9.	Ditto,	right.
t 10.	Shaft of tibia,	right.
t 11.	Tibia,	right.
m 1.	Tarso-metatarsal bone, left (eighteen inches and a half long, five inches across distal end).	
m 2.	Tarso-metatarsal bone,	left, ends broken.
m 3.	Ditto,	left.
m 4.	Ditto,	left.
m 5.	Ditto,	left.
m 6.	Shaft of ditto,	left.
ph. 1.	A second phalanx.	
ph. 2.	A third (?) phalanx.	

Total number of bones 47.

The first cursory comparison of the femora, tibiæ, &c. sufficed for the recognition of common characters, by which, notwithstanding their very different sizes, they appeared to be generically related to each other, and were readily distinguishable from their analogues in the skeletons of the existing Struthious birds.

A much closer inspection and cautious consideration were obviously required, in order to determine satisfactorily whether the different-sized bones belonged to different-aged birds of the same species, or to distinct species differing in size. Guided by the seldom-failing law, that distinctive characters are most strongly developed in the peripheral parts of the body, I first collected together and examined the bones of the foot, and fortunately found for comparison three tarso-metatarsal bones of the same side, the left, and of very different sizes.

Metatarsi. (Plates XXVII. and XXVIII.)

I shall first premise the common or generic characters of the tarso-metatarsal bone of the *Dinornis*, and, in detailing the subsequent comparisons of the different-sized bones, shall refer to them, as afterwards to the *tibiæ*, *femora*, &c., by the numbers they bear in the foregoing list, which will obviate much unnecessary repetition.

The tarso-metatarsal bone of the *Dinornis* consists of the tarsal and of three primitively distinct metatarsals blended together, and forming, as usual, a single bone, divided at the distal extremity into three trochlear articulations, for the three toes. The proximal articulation presents two concavities, the inner one the deepest, and the dividing ridge is slightly produced upwards at its anterior termination into a conical obtuse process. At the middle of the back part of the proximal end there are two short and thick longitudinal ridges, divided by a deep round groove for the flexor tendon of the toes: the ridges are supported by a thick longitudinal eminence, which is continued down the middle of the back-part of the bone to a varying distance in the different bones, gradually subsiding as it descends. On each side of the upper part of this median longitudinal eminence there is a foramen, as in most other birds, from which a shallow and narrow longitudinal canal is continued in the larger metatarsi for some distance down the bone: there are no other canals, nor any longitudinal angular ridges at the back part of the metatarsus; nor is there the slightest trace of a surface for the attachment of a hind-toe. On the anterior part of the bone, near the proximal end, there is the usual depression, in which the canals continued from the two posterior foramina terminate by a single foramen: below the depression there is a rough surface, for the insertion of the tendon of the *tibialis anticus*, from which point a median wide and shallow channel extends a certain way down, and divides into two shallower depressions, which diverge to the interspaces of the distal articular condyles: the margins of all these depressions are rounded off, and the general surface of the anterior, as of the posterior part of the metatarsus, is smooth and rounded: this, with the great breadth of the bone as compared with the metatarsi of other *Struthionidæ* and tridactyle *Grallæ*, constitutes the principal generic character of the tarso-metatarsal bone in the *Dinornis*. The interspaces of the three articular terminations are wider, the two lateral ones diverging more, and being of larger size than usual; they have also the median trochlear groove, but not so deep as in the middle articular process.

A section of one of the smaller metatarsals shows the confluent compact walls of the three primitive constituents of the shaft, and the two thin bony partitions dividing the cavity of the bone into the three separate medullary canals, as far down as the middle of the shaft, where they cease, and a common medullary cavity is formed: the lower part of the common medullary cavity is divided by a single septum into two canals, which are continued into the coarse cellular structure of the divisions supporting the articulations of the inner and middle toes, as in most other birds.

The length of the tarso-metatarsal bone in the *Dinornis* is about half that of the tibia, as will be afterwards more particularly demonstrated. In the tridactyle Emeu the tarso-metatarsal bone is as long as the tibia; in the Ostrich and the Bustard it is a little shorter than the tibia. The still shorter proportion which it bears to the tibia in the Apteryx of New Zealand forms a striking resemblance between this bird and the *Dinornis*. But the Apteryx is distinguished from the larger *Struthionidæ* not more by its elongated slender bill than by the presence of a fourth small toe on the inner and back part of the foot, articulated to a slightly raised rough surface of the tarso-metatarsal, about a fourth of the length of that bone from its trifid distal end: the Dodo was also tetradactyle, like the Apteryx. Thus the tarso-metatarsal bone of the *Dinornis* distinguishes that bird generically by its structure from the two last-named *Struthionidæ*, as it does by its shorter and stouter proportions from the Cassowary, the Emeu and the Rhea: the three well-developed anterior toes more obviously distinguish the *Dinornis* from the didactyle Ostrich.

Proceeding now to the comparison of the three most perfect tarso-metatarsal bones of the *Dinornis* with each other, it will be obvious, from the subjoined table of admeasurements, that they differ from each other in their proportions as well as in their size.

Dimensions of the Tarso-metatarsals.

	m 1.		*m* 2.		*m* 3.		*m* 5.		*m* 4.	
	In.	Lin.	In.	Lin.	In.	Lin.	In.	Lin.	In.	Lin.
Length	18	6	14[1]	0	12	0	7	0	6	10
Circumference	5	6	4	3	4	3	3	3	3	3
Breadth of distal end	5	1			4	0			3	0
Breadth of middle of shaft	1	11	1	6	1	6	1	5	1	3
Thickness, or antero-posterior diameter of ditto	1	6	1	2	1	1	0	9	0	9

Thus the circumference of the middle of the shaft is as 11 to 37, or less than one-third in the longest bone (*m* 1)[2]; in the second-sized entire bone (*m* 3)[3] it is a little more than

[1] According to the probable proportions of the articular extremities, when entire.

[2] Pl. XXVII. fig. 1. [3] *Ib.* fig. 2.

one-third; in the smallest metatarsal (*m* 4)[1] it is a little more than one-half. Again, the breadth of the distal end of the smallest metatarsal is nearly one-half the length of the bone; in *m* 3 it is just one-third; in *m* 1 it is two-sevenths. The difference is well marked in the proportions of the breadth or lateral diameter of the shaft, as compared with the thickness or antero-posterior diameter, but is less between *m* 1 and *m* 3 than between either of these and *m* 4 or *m* 5. In regard to these smallest-sized metatarsals, they both present differences of configuration when compared with the larger metatarsals, besides those indicated by the admeasurements, which assist in establishing a distinction of species: the distal end of the bone is more suddenly expanded than in the larger specimens; the proximal posterior prominence of the middle division of the metatarsal more rapidly subsides as it descends; there is no longitudinal channel continued downwards from the hole on the inside of this prominence, such channel being as well marked in the larger metatarsals as the outer one: the shallow concavity on the outside of the prominence is relatively broader in the smaller metatarsals. The inner concavity of the proximal articular surface is relatively deeper in *m* 4. The median longitudinal concavity, below the rough depression at the anterior part of the proximal end of the bone, is hardly discernible in *m* 4, but is well marked in *m* 1 and *m* 3. Finally, the small metatarsal, which is but half the length of *m* 3, and but one-third the length of *m* 1, has all the characters of the compound tarso-metatarsal in a fully mature bird: there is no trace of the original separation of the proximal epiphysis; and, with respect to that of the three primitive constituents of the shaft of the bone, it is as obscurely indicated as in other old tridactyle birds, by the two small holes at the back and upper part of the bone. I infer, therefore, from the smallest metatarsals, *m* 4 and *m* 5, which have the same characters and nearly the same size, the former existence of a distinct species of three-toed Struthious bird, differing from the larger species of *Dinornis* in its relatively shorter and broader metatarsus. In this character the present species of *Dinornis* closely resembled the extinct Dodo (*Didus ineptus*, Linn.) of the Isles of France and Rodriguez; and as it could not have been greatly superior in size, I propose therefore to designate it *Dinornis didiformis*.

Like the larger species of *Dinornis*, there is not the slightest trace of the articulation of a fourth or posterior toe in the metatarsal of the *Dinornis didiformis*; the generic distinction from *Didus* and *Apteryx* being thus distinctly indicated in all the tarso-metatarsal bones of the present collection.

If the different proportions and configurations of the smallest tarso-metatarsal bones justify the conclusion that they belonged to a particular species of *Dinornis*, by parity of reasoning the same inference must be drawn in regard to the intermediate-sized tarso-metatarsal, *m* 3, which is far from repeating the proportions of the largest bone, *m* 1, as the table of dimensions already referred to demonstrates: *m* 3 is in fact a more robust bone, in proportion to its length; the anterior longitudinal concavity, commencing below the rough depression, is deeper; the channel leading to the cleft between the condyles

[1] Pl. XXVII. fig. 3—6.

for the outer and middle toes is also relatively narrower and deeper; the posterior commencement of the middle condyle projects further and more abruptly in *m* 3 than in *m* 1; the posterior part of the distal half of the bone is more convex.

These may perhaps be deemed by some Ornithologists to be slight or trivial differences; yet, taken in connection with the greater breadth and thickness of the bone, in proportion to its length, they unquestionably support the conclusions of specific distinction deducible from those proportions.

The Physiologist contending for a difference of age merely in the birds to which the bones *m* 1 and *m* 3 belonged, must be prepared to show that in other large Struthious birds the tarso-metatarsal bones alter in their proportions as well as their size in the progress of growth, and that they are thicker and more robust in the young than in the old birds. The contrary is however the case in the Ostrich and the Common Fowl. In the great existing Struthious bird more especially, which offers the most instructive analogy in the present comparison, the tarso-metatarsal bone is relatively more slender in proportion to its length in the young bird than in the old, at least at the period of growth when the tarso-metatarsal bone has attained two-thirds its full size, which is precisely the proportion which the bone of the Dinornis *m* 3 bears in length to the bone *m* 1.

But the comparison with the bones of the young Ostrich brings to light another character, which effectually decides the question of the relation between the two different-sized bones of the Dinornis under consideration. In all birds the tarso-metatarsal bone, as is well known, is an aggregate of several distinct ossicles, the primitive separation of which continues longest in those birds whose respiratory, circulating and muscular energies are least developed. Thus in the Penguins the three metatarsal bones are almost quite distinct from one another throughout life; and in the Ostrich and other *Struthionidæ* deprived of the power of flight, the primitive separation of the metatarsals continues at their extremities to nearly full growth. In the tarso-metatarsal bone of the young Ostrich (Pl. XXVIII. fig. 1 & 2.), which is figured to illustrate this condition, and which is rather more than two-thirds the length of the same bone in the mature bird, the tarsal bone, which seems to represent a proximal epiphysis, is still a detached bone, and the posterior channel of the metatarsus deepens and widens as it approaches the proximal extremity, and is finally lost in the two deep and narrow clefts which divide the proximal ends of the three constituent metatarsals from each other.

But the tarso-metatarsal of the Dinornis, *m* 3[1], has all the characters of the bone of not only a mature but an aged bird. The tarsal bone is completely confluent with the upper ends of the metatarsals, and these are blended with each other, as far as their diverging distal condyles. The traces of the proximal separation are limited to a rough depression and a round excavation above it, on the anterior part of the bone, and to the two small perforations on the posterior part, the relics of the original fissures. He, therefore, who would contend that the tarso-metatarsal bone *m* 3 has belonged to a young

[1] Pl. XXVII. fig. 2.

individual of the same species of Dinornis as that to which the great tarso-metatarsal bone *m* 1 belonged, virtually assumes that the relations which modify the progress of ossification were different in the Dinornis from what they are in the Ostrich, and that a bird which, from the non-extension of the air-cells into the femur, was as poorly endowed with powers of flight as the Apteryx, and consequently possessed of as comparatively low circulating and respiratory energies, must at the same time have enjoyed as rapid an ossification of the skeleton as the Swallow; postulates which, being contrary to known physiological correlations, are inadmissible.

Since, therefore, the tarso-metatarsal *m* 3 combines with the characters of a fully developed bone, a marked difference of size, different proportions, and some minor modifications of form, as compared with the large bone *m* 1, it must indicate a second species of Dinornis, which, as it attained, as will be presently shown, the average height of the Ostrich (*Struthio camelus*), I shall call *Dinornis struthoides*.

That the *Dinornis struthoides* is in fact a good and true species, is put beyond all cavil or doubt by the existence of a tarso-metatarsal bone (*m* 2)[1] which is longer than *m* 3, but agrees in the proportions and form of its shaft with *m* 1, and manifests the same characters of immaturity which have been already noticed in the corresponding bone of the young Ostrich. Here, therefore, we actually have, what *m* 3 might have been mistaken for, a bone belonging to a young individual of the gigantic species (*Dinornis giganteus*).

The condition of this young bone demonstrates, what could not indeed be reasonably doubted, that a more tardy ossification coexists in the Dinornis, as in other *Struthionidæ*, with the absence of the powers of flight; and as such a condition in the present bone establishes the maturity of the tarso-metatarsal bone *m* 3, which it exceeds in length, it proves, *à fortiori*, that the smallest tarso-metatarsal, with all the characters of mature age, could not have belonged to a young individual of either of the two larger species. Or, in other words, if the young of the *Dinornis giganteus*, when the shaft of its tarso-metatarsal bone is eleven inches long, manifests evident marks of immaturity, these characters ought to have been more strongly marked in the shorter tarso-metatarsals *m* 3[2] and *m* 5[3], if they had really belonged to young individuals of the largest species. The marks of immaturity in the shaft of the tarso-metatarsal of the young *Dinornis giganteus*, *m* 2, are the gradual deepening and widening of the anterior median channel of the shaft as it approaches the proximal end of the bone, until it divides into the fissures separating the proximal ends of the three constituent metatarsals, which extremities in the specimen are broken off immediately above the point where they begin to coalesce. In a specimen of the tarso-metatarsal bone, *m* 6, of the *Dinornis didiformis*, in which the proximal end is broken off a few lines above the anterior rough depression which indicates the primitive dividing groove, the constituent metatarsals are faintly indicated by

[1] Pl. XXVIII. fig. 3. [2] Ib. fig. 5. [3] Ib. figs. 6 & 7.

two diverging lines of a denser cancellous structure, where the unclosed fissures exist in the younger bone. The shaft of the bone *m* 6, which is less than half the length of the mutilated one of the immature *Dinornis giganteus*, equals it in breadth.

Tibiæ. (Plates XXV. and XXVI.)

The chief generic characters of the tibia of the Dinornis are, the broad and wide concavity (Pl. XXVI. *a*) anterior to the proximal articular surface, the great breadth of the ascending wall of bone, *ib. b*, for the implantation of the rotular or extensor tendon, and, at the distal end, the slight anterior production of the lateral ridges of the trochlea. All these characters are very strikingly distinctive when the tibia of the Dinornis is compared with that of the Ostrich; the difference is less, though well marked, in relation to the Emeu or Apteryx. The tibia of the Dinornis differs from that of all known existing Struthious birds in the presence of the canal above the distal trochlea on the anterior and inner side of the bone, formed by the oblique osseous bridge (Pl. XXV. *f*) across the extensor tendon. The affinity of the Dinornis to the Bustard and other *Grallæ* is indicated by this structure. The inner condyle or division of the distal trochlea, *ib. g*, is relatively more produced backwards than in the *Struthionidæ* and *Grallæ* generally.

The anterior crista (Pl. XXV. *c*) at the head of the bone is less developed than usual. The longitudinal ridge (Pl. XXVI. *d*) for the fibula on the proximal half of the bone is well marked; but the fibula has not been anchylosed to it, nor is there any trace of that bone in the present collection. The orifice of the medullary artery (Pl. XXVI. *e*) is close to the termination of the fibular ridge.

Notwithstanding the great length of the largest tibiæ, they are relatively thicker than in the Ostrich and other known long-legged birds; and this character of strength is more marked in the smaller tibiæ. Of the eleven more or less complete tibiæ in the present collection six are nearly of the same size; four of these (*t* 3, *t* 4, *t* 8 and *t* 9, Pl. XXV. & XXVI. fig. 2.), which are entire and average a length of fifteen inches and two-thirds, do not vary in length to the extent of one inch: the two shafts, *t* 5 and *t* 10, belonged to tibiæ of the same dimensions. The three tibiæ (*t* 1, *t* 2, *t* 6), which are double the dimensions of the foregoing, vary in length five inches, the shortest of the three (Pl. XXV. & XXVI. fig. 1.) being twenty-nine inches in length, the longest thirty-five inches, and the one with incomplete extremities (*t* 6) obviously being of intermediate length. The length of the second long shaft (*t* 7) must have been nearly midway between fifteen and thirty-four inches. The tibia (*t* 11, Pl. XXV. & XXVI. fig. 5.) is not longer than that of the Great Bustard (*Otis tarda*).

Both this and the tibiæ *t* 3, *t* 4, *t* 8, *t* 9 have the characters of maturity as well marked as in the two largest tibiæ, but I shall at present limit the comparison between *t* 2 and *t* 4, as the respective representatives of the gigantic bones, and of the four tibiæ which present half their dimensions.

A reference to the subjoined table of admeasurements will show that *t* 4 (Pl. XXV. & XXVI. fig. 3.) is thicker in proportion to its length, has relatively broader proximal and distal extremities, and a longer ridge for the attachment of the fibula.

Tibia.	*t* 1.		*t* 2.		*t* 7.		*t* 4.		*t* 3.		*t* 8.		*t* 9.		*t* 11.	
	In.	Lin.	In.	Lin.	In.	Lin.	In.	Lin.	In.	Lin.	In.	Lin.	In.	Lin.	In.	Lin.
Length	35	0	29	0	25[1]	0	16	3	15	6	15	4	15	4	8	9
Breadth of proximal end	7	6	6	2	0	0	4	6	4	5	0	0	0	0	2	0
Breadth of distal end	4	0	3	7	0	0	2	4	2	4	0	0	0	0	1	3
Circumference of middle	6	6	5	3	5	0	4	1	4	0	0	0	0	0	1	11
Fibular ridge extends down	13	0	12	0	0	0	7	0	6	10	0	0	0	0	3	6

The anterior ridge *c* at the proximal end of the bone is nearer the middle in *t* 4 than in *t* 2 (Pl. XXV. & XXVI. fig. 1.), the interspace between that and the external ridge being of the same breadth in both, notwithstanding the difference of total breadth. The external proximal ridge curves more abruptly outwards from the shaft of the bone in the small than in the large tibia, whereas the contrary character ought to have been manifested if the difference of size had depended on difference of age, such muscular ridges being more strongly produced in old than in young birds. The shaft of the bone is flatter antero-posteriorly, compared with its breadth, in the small than in the large tibia, and is more nearly triedral, owing to the greater flatness of the inner and anterior surface and the less rounding off of the inner margin. All the four tibiæ of from fifteen to sixteen inches in length correspond in these differential characters, when compared with either of the two gigantic tibiæ; and the two mutilated shafts of the smaller tibiæ equally differ in the subtriedral character from the mutilated shaft of the large tibiæ.

At the distal end of the bone, the angle formed by the posterior contour of the condyles is of a different form in *t* 2 (Pl. XXV. fig. 2.) and *t* 4 (Pl. XXV. fig. 4.): in the latter the outer condyle forms a greater proportional share of the articular surface, and the line of the inner one *g* extends more abruptly backwards.

All the shorter tibiæ, as before observed, present the characters of full maturity; the ridge for the fibula and those at the proximal end of the bone are quite as strongly developed as in the tibiæ of double the length.

In the tibia of a half-grown Ostrich I find the antero-external ridge, which in the adult projects strongly from the head of the bone, in the state of cartilage, the fibular ridge undeveloped, and both articular extremities in a state of epiphysis and incompletely ossified: the same conditions which influence, as has been already remarked, the tardy ossification in the Ostrich must have been still more operative in the Dinornis, in which the absence of air in the femur indicates as low a development of the respiratory system as in the Apteryx.

If this reasoning be admitted to establish the maturity of the bones *t* 3, *t* 4, *t* 8, *t* 9, it equally proves that of the tibia *t* 11 (Pl. XXV. & XXVI. fig. 5.), which bears the

[1] According to the obvious proportions of the articular extremities when entire.

same proportion to the bone of sixteen inches in length, as this does to that of thirty-five inches. The tibia of eight inches and two-thirds in length has its articular extremities as completely ossified and confluent with the shaft, and its proximal and fibular ridges as strongly developed, as in the larger tibiæ. The shape of its proximal articulation (Pl. XXVI. fig. 6.) differs more from that of *t* 4 than this does from that of *t* 2; the tibial half is broader from behind forwards than transversely; the anterior ridge at the proximal end is nearer the middle of the bone than in *t* 4, *à fortiori*, nearer than in *t* 2; the inner side of the bone is more rounded or less angular, especially at the proximal half of the shaft; the transverse diameter of the shaft is proportionally less than the antero-posterior one; the posterior notch between the distal condyles is deeper, and the inner condyle (Pl. XXV. fig. 6. *g*) is more compressed laterally, and is produced further backwards. There is no tarso-metatarsal to match the tibia *t* 11: this bone unequivocally establishes a fourth species of cursorial bird, which, from the agreement of the bone in its general characters with the tibiæ of the larger species, most probably belonged to the same genus, Dinornis, but did not surpass in size the Great Bustard (*Otis tarda*). I propose, therefore, to name the species to which it belonged, *Dinornis otidiformis*.

The distal articular surface of the longest tibia, *t* 1, fits the proximal joint of the longest tarso-metatarsal, *m* 1. There is no tarso-metatarsal bone corresponding with the tibia *t* 2. This bone agrees more closely in its proportions and configuration with *t* 1 than with *t* 4: from the latter it is evidently specifically distinct, but less clearly so from the largest tibia. Yet the difference of size is sufficiently striking; too great, without other evidence, to justify the assumption that it depends on difference of sex; and the mature characters of the shorter bone *t* 2 militate against the supposition of a difference of age. At the proximal extremity the external ridge is relatively less produced but thicker and stronger in *t* 2, and the internal condyle or boundary is broader in *t* 2. In the next section we shall find that there are different-sized femora with equally mature characters which correspond respectively with *t* 1 and *t* 2. These considerations induce me to regard *t* 2 as indicative of a distinct species of Dinornis which must have stood about nine feet in height, and may be provisionally called '*Dinornis ingens.*'

The smallest tarso-metatarsal bones in the present collection, *m* 4, *m* 5, *m* 6, correspond precisely with the tibiæ *t* 3, *t* 4, *t* 8, *t* 9. The proportions of the shaft *t* 7 correspond with those of the intermediate metatarsal, *m* 3.

Femora. (Pl. XXI. XXII. XXIII. XXIV.)

The femur is remarkable for its great strength and the expansion of its extremities: the smallest diameter of the shaft is one-seventh the length of the entire bone. The trochanter *a* is unusually broad, thick and elevated; the distal extremity is still more remarkable for its great size, and especially for the breadth of its rotular concavity *d*.

The shaft is rounded, not compressed and subtriedral as in the Ostrich: in no bird are the muscular ridges and tuberosities so strongly developed on the posterior part of the shaft: the orifice of the medullary artery is at the middle of this surface. The popliteal space is deeply excavated. There is a rough deep oval depression at the upper and back part of the outer condyle. In only one out of eighteen femora are the parietes of the bone deficient at the part where the air is admitted into the interior of the shaft in the Ostrich, Emeu, Rhea, and Cassowary; but in the exceptional instance cited (Pl. XXIX. fig. 1.) the cavity *h* does not lead to the interior of the bone, and may be due to accidental fracture, as there is a similar opening on the opposite side. In all the other femora of the Dinornis the parietes at the back part of the proximal extremity of the bone are entire, as in the Apteryx; and both the weight and cancellous structure of these bones prove the accuracy of the statement made in the description of the original fragment, that the Dinornis retains the medullary contents of the cavities of the femur throughout life, as in the Apteryx, which is the only other known example of a terrestrial bird in which the air is not admitted into any of the bones of the extremities.

The absence of the air-hole and air-canal, the great thickness of the dense bony wall of the medullary cavity of the shaft[1], the tuberosities on the back part of the shaft, the great size of the distal end of the femur, and especially the great breadth of the rotular cavity, constitute the chief generic characters of this bone in the Dinornis.

Dimensions of the Femora.

Femur.	*f* 1.	*f* 2.	*f* 3.	*f* 12.	*f* 13.	*f* 6.	*f* 16.	*f* 8.	*f* 7.	*f* 17.	*f* 10.
	In. Lin.	In. Lin.	In. Lin.	In. Lin.	In. Lin.	In. Lin.	In. Lin.	In. Lin.	In. Lin.	In. Lin.	In. Lin.
Length	16[2] ?	13 0	0 0	11 0	9 6	9 4	9 6	8 0	8 0	8 1	0 0
Breadth of proximal end (in the axis of the neck)	0 0	4 10	0 0	4 2	3 5	3 6	3 6	2 10	3 0	3 3	0 0
Breadth (transverse) of distal end	0 0	5 2	0 0	4 3	3 9	3 7	3 7	3 3	3 2	3 6	0 0
Circumference of middle	7 3	6 1	6 0	5 6	5 1	4 1	4 3	4 0	4 0	4 3	2 1

Of the eighteen femora transmitted to England, eleven of which are more or less complete, and the dimensions of most given in the subjoined table, there is a more regular gradation of size than in the tibiæ and metatarsi; and, as the table demonstrates, a greater correspondence in their general proportions.

Nevertheless it is obvious that there is a similarity of size in a certain number, which, if the maturity of the bones be granted, must therefore indicate particular species. Thus, whether we glance at the series of the bones themselves, or on the table of admeasurements, we have no hesitation in grouping together *f* 6, *f* 16, the length of which ranges between $9\frac{1}{3}$ inches and $9\frac{1}{2}$ inches: *f* 13, though similar in length, is obviously a

[1] Compare fig. 1 with fig. 2 in Pl. XXIX.

[2] According to the obvious proportions of the articular extremities if entire.

thicker and stronger bone, and yet has more signs of immaturity. We in like manner associate together *f* 7, *f* 8, *f* 17, as not varying beyond a line from the length of eight inches.

In the first four femora, *f* 1, *f* 2, *f* 3, *f* 12, enumerated in the table, there is a more regular gradation of size. The left femur, *f* 12, is eleven inches, and the shaft of a right femur, *f* 4, so precisely corresponds in circumference and other proportions as to leave no doubt as to their similarity in length, and render it highly probable that they belonged to the same bird. The femora *f* 2 and *f* 3 were thirteen inches in length; and the shaft *f* 1 indicates a femur of at least sixteen inches in length.

In an Ostrich the circumference of the femur, of the tibia, and of the metatarsus is respectively five inches three lines, four inches three lines, and three inches seven lines. In an Emeu the circumference of the same bones is respectively three inches seven lines, three inches four lines, and three inches.

From these analogies we may conclude that the shaft of the femur *f* 1, with a circumference of seven inches and three lines, may have belonged to a Dinornis with the largest tibia whose circumference is six inches six lines, and with the tarso-metatarsal bone whose circumference is five inches six lines, the proportionate thicknesses of these bones to each other being intermediate in their degrees to those presented by the same bones in the Ostrich and the Emeu. It must be remembered that the relative length of the femur and metatarsus is very different in the Dinornis from that in existing *Struthionidæ*, the Apteryx excepted; but, according to the above collocation of the femur, tibia and tarso-metatarsus of the largest *Dinornis*, the tarso-metatarsus exceeds the femur in length by $2\frac{1}{2}$ inches in this species, which I have named *Dinornis giganteus*. The femur *f* 2 presents a similar correspondence with the tibia *t* 2; but its excess of length over the tarso-metatarsus *m* 3 renders it very improbable that they could belong to the same species, especially when the difference in their circumference is added, that of the femur being six inches one line, that of the metatarsus four inches three lines; besides, the distal articulation of the tibia *t* 2 is obviously too large for the articulation of the metatarsus *m* 3. The femur *f* 12 offers the required correspondence with the metatarsus *m* 3 of the *Dinornis struthoides*, which exceeds the length of that femur by one inch, and is consequently but a little shorter in proportion than in the largest species.

The tarso-metatarsus is proportionally still shorter in the third species (*Dinornis didiformis*), to which I refer the femora *f* 7, *f* 8, *f* 17, the tibiæ *t* 3, *t* 4, *t* 5, *t* 8, *t* 9, *t* 10, and the tarso-metatarsal bones *m* 4, *m* 5, *m* 6. The tibia, according to this allocation, being, like that of the gigantic Dinornis, little more than twice the length of the femur, we may with great probability associate the shaft of the tibia, which, when restored, gives a length of twenty-five inches, with the femur of the *Dinornis struthoides* measuring eleven inches in length.

The proportions of the three principal bones of the leg in the Ostrich, the Emeu, the

Apteryx and the three species of *Dinornis*, as above restored, are given in the subjoined table.

	Ostrich.	Emeu.	Apteryx.	*D. giganteus*[1].	*D. struthoides*[2].	*D. didiformis*[3].
				f 1.	*f* 12.	*f* 8.
	In. Lin.	In. Lin.	In. Lin.	In. Lin.	In. Lin.	In. Lin.
Length of femur	11 0	9 0	3 9	16 0	11 0	8 0
Circumference of ditto..	5 3	3 7	1 0	7 3	4 2	4 0
				t 1.	*t* 7.	*t* 4.
Length of tibia........	18 6	16 10	5 3	35 0	25 0	16 3
Circumference of ditto..	4 3	3 4	1 3	6 6	5 0	4 1
				m 1.	*m* 3.	*m* 5.
Length of metatarsus ..	16 0	15 0	3 3	18 6	12 0	7 0
Circumference of ditto..	3 7	3 0	0 0	5 6	4 3	3 6

It will be seen that in these three species of Dinornis the united lengths of the femur and metatarsus equal or nearly equal that of the tibia, and that the metatarsus is relatively shorter and thicker as the species decrease in size.

The femur *f* 2 and the tibia *t* 2 of the *Dinornis ingens* have no metatarsus to match them in the present collection: such a metatarsus should be fifteen inches in length. Whether the *Dinornis* with a hind-leg of these proportions be actually a distinct species from the *Dinornis giganteus*, or a smaller individual on account of age or sex, is a question which, though the present evidence induces me to answer in the affirmative, I should be glad to see confirmed by additional specimens.

With respect to the smaller femora, especially those numbered *f* 7, *f* 8, *f* 17, if they had belonged to the young birds of the larger species, their nonage would unquestionably have been indicated by the characters of the bones. The femur of a young Ostrich, bearing the same proportion to that of the adult which *f* 7 bears to *f* 12, has the whole upper surface of the proximal end and all the distal articulation covered with thick cartilage, and the line of the terminal epiphysis is conspicuous, although the uniting ossification has commenced; the trochanterian ridge is rounded off; the surface of the shaft of the bone is smooth; the muscular ridges quite undeveloped. In the small femora of the Dinornis, *f* 7, *f* 8, *f* 17, no trace of the separation of the terminal epiphyses remains; the sculpturing of the articular surfaces is sharp and bold; every ridge and tuberosity indicative of muscular action is as strongly developed as in the largest femora.

The same characters establish the maturity of the femora *f* 6 and *f* 16; *f* 13 has the muscular ridges and prominences less strongly developed. There are no tibiæ or metatarsi which, upon the analogies and proportions adopted for the collocation of the principal bones of the leg in the *Dinornithes giganteus, ingens, struthoides* and *didiformis*, can be assigned to these femora. Regarding which, therefore, it is first to be inquired whether they belong to immature individuals of *Dinornis struthoides* or to a distinct sex

[1] Pl. XXX. fig. 1. [2] Ib. fig. 2. [3] Ib. fig. 4.

of *Dinornis didiformis*, characterized by superiority of size, or to a distinct species of Dinornis.

Comparing the femora *f* 6, *f* 13 (Pl. XXIII. fig. 1.) and *f* 16 (*Ib.* fig. 2.) with each other, it was obvious that one of them differed in its proportions from the rest, *f* 13 being relatively thicker, as is shown in the plate and in the table of admeasurements. This femur corresponded much more closely with the femur *f* 12 (Pl. XXI. fig. 3.) in its general form, its ridges and tuberosities; but these were less strongly developed, and the manner and extent of abrasion of both proximal and distal articular surfaces would well accord with the supposition of their having been in that cartilaginous or less completely ossified state which characterizes the femur of a bird not quite fully arrived at maturity. The state of development of the muscular ridges and tuberosities forbids the reference of this femur to a very young bird, but supports the conclusion that the bone had belonged to an individual as far advanced in growth as is indicated by the difference in size between it and the femur *f* 12.

The different condition and proportions of the two remaining femora, of $9\frac{1}{2}$ inches in length, *f* 6 and *f* 16, establish their specific distinctions from the femora *f* 13, *f* 12 and *f* 2. Of this I think no doubt can be entertained by any anatomical naturalist who may inspect the plate (Pl. XXIII.) containing the figures of *f* 13 and *f* 16, selected for the comparison, or who may give due consideration to the following statement of their differential characters.

These bones are of equal length but of unequal thickness: the shape of the shaft of the bone is also different; the relative antero-posterior diameter of *f* 13 is much greater than that of *f* 16, especially at the proximal end and trochanterial enlargement of the shaft, and just above the inner condyle: the anterior surface of the proximal part of the shaft presents a shallow equable concavity in *f* 16 which is not present in *f* 13. In *f* 16 a pretty sharp ridge leads from the middle of the posterior surface of the shaft obliquely to the upper and posterior angle of the inner condyle, and the posterior surface of the expanded shaft above the condyles is regularly excavated by a moderate concavity which is continued uninterruptedly into the inter-condyloid depression. In *f* 13 an oblong rough tuberosity, with its long axis parallel with that of the bone, exists in the place where we find the oblique ridge in the other bone, the tuberosity being separated from the upper and posterior angle of the inner condyle by a smooth channel or depression, which leads to an oval depression much deeper and more circumscribed than is the corresponding concavity in *f* 16. The complete development of the muscular ridges and tuberosities, with the better preserved state of the articular extremities, show the femur *f* 16 to be a more mature bone than *f* 13; the differences in proportion and configuration prove it to belong to a distinct species from *Dinornis struthoides*.

We next come to the question whether the femora *f* 6 and *f* 16 belong to the species *Dinornis didiformis*, founded on the femora *f* 7, *f* 8, *f* 17, the tibia *t* 3, *t* 4, *t* 5, *t* 8, *t* 9, *t* 10, and the metatarsi *m* 4, *m* 5 and *m* 6, and whether the femora *f* 6 and *f* 16 represent a sexual superiority of size, or are specifically distinct from the shorter femora.

If the discrepancy of the thickness of the shaft as compared with the length of the bone be sufficiently obvious in femora of equal length, like *f* 13 and *f* 16 (Pl. XXIII.), it becomes still more striking when the more robust proportions are exhibited in a femur of shorter size, which is one of the first differences that strike the eye in comparing *f* 6 and *f* 16 (Pl. XXII.) with *f* 7, *f* 8 and *f* 17 (Pl. XXIV.). The table of admeasurements shows that the femur *f* 17, which is one inch and five lines shorter than the femur *f* 16, has very nearly an equal circumference of the middle of the shaft, and a quite equal breadth of the distal end, the antero-posterior diameter of the condyles being also the same in both. If the comparison of these two femora be pursued into further details, it is seen that the anterior margin of the great trochanter is more produced but narrower in *f* 16 than in *f* 17, that the anterior surface of the shaft is more convex, and that the anterior curve of the outer condyle is shorter in the longer femur: the antero-posterior diameter of the great trochanter and of the shaft, especially of that part leading to the outer condyle, is less in the longer femur. With regard to the configuration of the popliteal space, the same differences exist between *f* 16 and *f* 17 as have been already pointed out between *f* 16 and *f* 13, viz. a circumscribed tuberosity (*d*, fig. 2. Pl. XXIV.) in place of a continuous ridge (*d*, fig. 2. Pl. XXII.), a deeper and smaller instead of a shallower and larger concavity, &c.

In regard to the relation of these differences to sex, it is to be observed, that the male Ostrich slightly exceeds the female in size, and the difference between the two sexes of the Apteryx is relatively greater, yet the femora and other bones of the leg do not differ at all in proportions or configuration, but only in size, corresponding in degree with the rest of the body. I am not, indeed, aware of a single fact in the osteology of existing birds which would justify the conclusion that the differences presented by the femur *f* 16, as compared with *f* 17, were merely sexual. It has already been shown that the differences between *f* 16, as compared with the femora *f* 13 and *f* 12, cannot depend upon nonage, and, *à fortiori*, the femur *f* 16 cannot be regarded as belonging to a young individual of the gigantic species: there remains then only the conclusion that it must represent a fifth distinct species, of which there are neither tibiæ nor metatarsi in the present collection. I venture to surmise that the tibia, and especially the tarso-metatarsus of this species, will be found relatively longer and more slender than in the *Dinornithes struthoides* and *didiformis*: so much may be anticipated from the more slender proportions of the femur, which, moreover, resembles the femur of the Emeu in some of the characters by which it differs from the above species of Dinornis, viz. in the sharper anterior border of the great trochanter, the more equable and deeper concavity between this border and the head of the femur, and in the uninterrupted ridge leading from the middle of the back part of the bone to the inner condyle. The generic characters of Dinornis are, however, manifested in the absence of the air-hole and air-cavity of the femur, the greater robustness of the bone in this the least robust of the genus, the much higher trochanter, the much wider distal extremity, and especially the wider and shallower cavity for the patella. From the equality of size of this femur with that of the Emeu, the species which it indicates may be termed *Dinornis dromæoides*.

Pelvis. (Plates XIX. XX. & XX *a*.)

The first portion of the pelvis here described consists of twelve anterior anchylosed vertebræ of the sacrum, with a portion of the right ilium and acetabulum (Pl. XIX. fig. 1.). Of the size of this fine fragment an idea will be given by the subjoined table of its dimensions, compared with those in a full-sized Ostrich.

	Dinornis, p 1.		*Struthio.*	
	In.	Lin.	In.	Lin.
Height of the first sacral vertebra	6	10	4	6
Breadth of the articular surface of the body of ditto . .	3	4	1	8
Breadth of the seventh sacral vertebra	3	3	1	3
Length of the first seven sacral vertebræ	6	6	6	9

The last admeasurement shows that the anterior part of the sacrum, including the first series of vertebræ provided with double transverse processes on each side[1], is shorter in proportion to its height and breadth compared with the Ostrich; and these proportions are shown to characterize the entire pelvis by the smaller specimen, subsequently to be described. The under surfaces of the first seven vertebræ are flattened, and form a smooth and slightly concave platform in the remaining four. The inferior transverse processes pass out horizontally to the lower border of the ilium, which descends to the level of the under surface of the bodies of the sacral vertebræ. In the Ostrich they ascend obliquely upwards to join the upper transverse processes, before abutting against the lower border of the ilium, which does not descend so low as the bodies of the vertebræ.

In the Ostrich the first two inferior transverse processes of the sacrum retain their primitive condition of detached ribs, and three transverse processes succeed them before the commencement of the os pubis. In the great Dinornis the second sacral rib is anchylosed as a transverse process, and four other processes succeed this before the one which abuts against the beginning of the pubis: this is much thicker and stronger than the preceding ones, and it is succeeded by four confluent sacral vertebræ, which have no lower transverse processes. In the Ostrich the transverse processes of the sixth sacral vertebra abut against the part of the innominatum from which the pubis is continued, and the transverse processes of the four succeeding vertebræ abut against the origin of the ischium, parallel with the lower part of the acetabulum; then a single vertebra without a lower transverse process or sacral rib intervenes before these are again developed, to abut against the posterior part of the acetabulum.

[1] See description of the sacrum in Birds, in the 'Cyclopædia of Anatomy,' art. AVES, p. 271.

The four ribless sacral vertebræ, which in the Dinornis are interposed between those which send their anchylosed ribs to abut upon the os innominatum anterior to the acetabulum, and those which strengthen in like manner the posterior part of the acetabulum, are very short; their bodies have coalesced into a single mass of bone, smooth and flattened below, rounded at the sides, and only recognizable as distinct bones by the orifices for the nerves at the sides of the anchylosed mass: these orifices are double, as in the sacrum of other birds[1], the two roots of the nerves escaping separately, the motor root issuing by the lower, the sensitive root by the upper orifice.

The upper transverse process of the first sacral vertebra is a broad and thick piece of bone, extending from the body and anterior articular process of the vertebra, and having a deep and smooth excavation at its anterior part: in the Ostrich the corresponding part is much smaller and is reticulated by the bars of bone dividing the orifices by which the air is admitted into the interior of the vertebra.

I shall not swell the extent of the present paper by pursuing farther the description of the structure of the pelvis of the Dinornis, as exhibited in the present striking fragment, but proceed to notice the other specimens of pelvic bones which have been enumerated as forming parts of the present collection.

The large portion of the right os innominatum, including the entire acetabulum (Pl. XX. fig. 1.), must have belonged to a bird of rather smaller size than the one to which the above-described portion of the sacrum belonged. The part of the ilium before and above the acetabulum rises with a steep slope and a slight general concavity to meet its fellow above the spinous crest of the anterior part of the sacrum: behind the acetabulum the outer surface of the ilium is divided into two facets, the upper one nearly horizontal, the lower one vertical, save where it arches out to the flat articular surface behind the acetabulum. The ridge dividing these two facets commences anteriorly above the middle of the acetabulum, and describes a regular curve in its course backwards, the convexity being downwards: in the Ostrich the corresponding ridge forms two curves, meeting at an angle above the prominent articular surface behind the acetabulum, and the convexity of both curves is upwards; from the angle an obsolete ridge extends down to the prominent articulation, and divides the anterior from the posterior vertically concave surfaces of the ilium: in the great Dinornis the corresponding surfaces are uninterruptedly continuous above the acetabular prominence. The posterior wall of the acetabulum (*f*) is incomplete, as in other birds; the smooth articular surface is continued upon an oblong prominence above and behind the cavity. The pubis (*d*), a slender bone, as usual in Birds, springs from a protuberance at the lower part of the acetabulum. The ischium (*e*) is continued more directly from the lower and back part of the cavity: a very slight ridge indicates the posterior boundary of the notch for the tendon of the obturator internus, and the upper border of the notch

[1] Cyclop. of Anat., art. Aves, p. 271. The Ostrich is the only exception to this rule with which I am acquainted.

is nearly straight. In the Ostrich this part is concave, and a well-developed process extends down, but does not join the pubis at the back part of the obturator notch. The Apteryx resembles the great Dinornis in this part of the pelvis. The ischium becomes compressed and gradually expands vertically as it extends backwards, its lower margin forming almost a straight line. In the Ostrich the ischium maintains its triedral form for a much longer extent and suddenly expands, the lower margin curving down to join the pubis (Pl. XIX. fig. 4. *e*) : there is no indication of such a junction in the present specimen, nor does the superincumbent ilium curve down, as in the Bustard, to join the ischium: both the ischiadic and the obturator notches seem to have been unclosed by bone in the Dinornis as in the Apteryx.

The third specimen of the pelvis of a Dinornis, *p* 4 (Pl. XIX. fig. 2. & Pl. XX. figs. 2 & 3.), is more entire, but much smaller than the foregoing. It seems to include all the sacral vertebræ, which are eighteen in number: seven anterior ones with the lower transverse processes, four without those processes, and seven in which they reappear, extending obliquely outwards and backwards to the line of junction of the ilia with the broad posterior part of the sacrum. The most important feature in the present pelvis is the demonstration of what was obscurely indicated in the foregoing specimen, viz. that the ilia do not, as in existing Struthious birds, including the Apteryx, approximate one another along the whole length of the sharp and narrow ridge formed by the spines of the sacrum, but that they diverge above the acetabula, to give place to a broad horizontal expanse of bone developed from the posterior sacral spines (Pl. XX. fig. 3. *b*), as in the Bustard and most other birds. This surface forms a smooth shallow concavity, perforated as usual by two lateral series of small foramina. From the pelvis of the Bustard that of the Dinornis differs in the greater relative depth and verticality of the anterior plates of the ilia, which meet above to form a ridge, as in the existing *Struthionidæ*: the posterior expanded part of the pelvis is relatively shorter than in the Bustard, and the difference is extreme which this part of the pelvis of the Dinornis presents, as compared with that of the Apteryx[1], the Ostrich, the Emeu, and *à fortiori* the Rhea, in which the ischiadic bones meet, and are united for a considerable extent below the posterior part of the sacrum, which there becomes almost obliterated.

The acetabula are relatively nearer to each other than in the Bustard, but farther apart than in the Ostrich, Emeu, and relatively than in the Apteryx. There is likewise another difference in the relative position of the acetabula as compared with the Ostrich: in this bird those cavities are so situated that their posterior wide orifice exposes to view the neural arches and spinous processes of the intervening sacral vertebræ. In the Dinornis only the lower part of the bodies of the corresponding vertebræ are seen by looking directly into the acetabulum (Pl. XX. fig. 2. *f*), and below these we have the open cavity of the pelvis: the Apteryx and Emeu resemble the Dinornis in this respect: nothing but the cavity of the pelvis is seen on looking directly through the acetabula

[1] See Zool. Trans. vol. ii. p. 291.

in the Bustard. The body of the third sacral vertebra is carinate below in the Bustard, and none of the vertebræ abut by their transverse processes against the anterior part of the acetabulum.

The smaller pelvis of the Dinornis, *p* 4, when compared with the portions of the larger pelves, *p* 1, *p* 2, presents so many differences besides those of size as to leave no doubt about the specific distinction of the birds to which they belonged.

The first sacral vertebra in the smaller pelvis (Pl. XX. fig. 2.) has a narrower and deeper body, and there is not the deep excavation on the anterior part of the upper transverse process : I do not lay much stress on the fact that the lower transverse processes of the first two sacral vertebræ retain the condition of ribs articulated to depressions at the upper part of the intervertebral spaces (*ib. a*) ; but every other part of the present pelvis manifests the characters of maturity. These ribs, as well as their anchylosed analogues, the transverse processes which succeed them, come off higher up than in the large pelvis. The lower border of the ilium is thin, and does not form a broad convex surface, increasing the width of the pelvis anterior to the acetabulum, as in the large Dinornis : the four inter-acetabular vertebræ without inferior transverse processes (*ib. b*) are carinate along their under surface, not flattened as in the great Dinornis. The upper facet of the posterior part of the ilium is more horizontal, and forms a right angle with the vertical facet (Pl. XX. fig. 2. *c*) : this is also divided from the anterior concave wall of the ilium, as in the Ostrich, by an angle formed by an obsolete ridge : the articular prominence behind the acetabulum is relatively longer in the axis of the pelvis, but less deep in the smaller species. The root of the ischium where it forms the upper part of the obturator notch is concave, and an angular process descends towards the pubis, forming a well-marked posterior boundary to the notch. In this character the smaller pelvis more resembles the pelvis of the Emeu than does that of the larger one ; but the ischial process does not quite reach, as in the Emeu, the pubic bone. The ischium resembles, in its gradual expansion and straight direction, that of the larger species, and the more perfect condition of the smaller pelvis proves that the extremity of this bone (*ib. e*) projects freely backwards, as in the Apteryx and Emeu.

The portion of a somewhat smaller pelvis, *p* 5 (Pl. XIX. fig. 3. Pl. XX. fig. 4.), than the preceding is less complete, but manifests characters which prove it to belong to a distinct species of Dinornis, and apparently to an older bird, since the second sacral rib on the left side is anchylosed to the vertebral interspace. This anchylosis sufficiently demonstrates that the smaller pelvis is not of a younger bird than the larger one ; and, besides the difference of size, there are the following differences of configuration :—In the smaller pelvis the second and third sacral ribs arise nearer the lower surface of the bodies of the vertebræ, a character by which the smallest pelvis approximates the largest one, from which it differs, in having the bodies of these vertebræ relatively less broad and flat. The extent occupied by the four posterior orifices forming the interspaces of the lower transverse processes of the third to the seventh sacral vertebræ inclusive, is three lines greater in the smallest pelvis, *p* 5, than in the one next in the order of size,

p 4. The bodies of the four vertebræ without lower transverse processes (b) are flatter below in the smallest pelvis than in p 4. The vacuity at the sides of these vertebræ, into which the posterior aperture of the acetabulum opens, is relatively much smaller in the p 5 than in p 4; but the two transverse processes of the twelfth and thirteenth vertebræ which abut against the posterior part of the acetabulum are absolutely much thicker in p 5 than in p 4. For example, the first of these transverse processes in the larger pelvis p 4 is one inch seven lines long and one and a half line broad: in the smaller pelvis it is ten lines long and four lines broad. Such differences are not manifested in the pelvis of individuals of the same species in other birds: they are associated in the present instances with minor differences in the shape of the acetabulum, especially of its posterior and inferior border, and in the relative breadth of the bodies of the posterior sacral vertebræ; the latter, however, might be a sexual difference. Seventeen of the sacral vertebræ are preserved in the specimen p 5, and the expanded spinous plate of the posterior ones is more perfectly preserved than in the preceding specimen, p 4. The following are some of the dimensions of p 4 and p 5, compared with those of the pelvis of an Emeu:—

	Dinornis, p 4.		*Dinornis*, p 5.		*Dromaius*.	
	In.	Lin.	In.	Lin.	In.	Lin.
Length of the pelvis	11	0	9	6	15	6
Greatest breadth at post-acetabular protuberance . .	6	9	5	10	4	0
——— depth at the origin of pubic bones	5	6	5	0	5	0
Breadth of the pelvis at the posterior part of the ilia .	3	6	0	0	1	9

After a summary of the characters which the different pelves of the Dinornis present in common, it is obvious that the genus recedes furthest from the Struthious type and makes the nearest approach to the tridactyle *Grallæ* in the structure of this part of the skeleton.

There remains to be determined, to which of the species of Dinornis already established by the bones of the leg, the three specifically-distinct pelves are to be referred. We cannot take the relative lengths of the pelves and femora of existing *Struthionidæ* as a guide, on account of the disproportionate length of the pelvis in them as compared with the Dinornis. The pelvis of the Bustard is also relatively longer than in the Dinornis. The size of the acetabulum is not so good a guide as in Mammalia, because it is always relatively larger than the head of the femur in Birds: thus, although the acetabulum in the portion of the pelvis p 2 is larger than the head of the entire femur f 2, the size of the post-acetabular articular prominence corresponds sufficiently closely with the articular surface upon the neck and trochanterian enlargement of that femur to render it probable that they belonged to the same species, if not individual. The fragment of the huge pelvis p 1 might well have belonged to a Dinornis of the largest stature. The two remaining specimens of pelvis are too small to be adapted to the femur f 12, but of the species indicated by that and the tarso-metatarsal bone m 3, there appears to be a small portion of a pelvis in the present collection.

This is a part of the right os innominatum, *p* 3 (Pl. XX. fig. 5.), including the posterior and inferior angle of the acetabulum, the origins of the pubis and ischium, which form the obturator notch, and a fractured continuation of the latter bone. The fragment has belonged to a pelvis intermediate in size between *p* 2 and *p* 4, but is nearer the former. From this it differs in the concavity of the upper boundary of the ischiadic notch, and the descending process forming its posterior boundary which almost touches the pubis. The posterior margin of the wall of the acetabulum is straight, and ascends at a right angle with the horizontal ischium. In the larger pelvis, *p* 2, as in the smaller one, *p* 4, this margin curves back at less than a right angle. The ischium is thinner and less convex internally.

The pelvis *p* 4 agrees in the proportions of its acetabula and the form of the posterior articular protuberance with the femora of *Dinornis dromæoides*; and the smaller pelvis *p* 5 offers the same correspondence with the femora of the *Dinornis didiformis*.

If a species of *Dinornis* intermediate in size between the *D. struthoides* and *D. didiformis* had not been indicated by the femora *f* 6 and *f* 16, I must have been led to the same conclusion by the two pelves, *p* 4 and *p* 5, as to the existence of such a species.

Since the foregoing description of the pelvic bones was put into type I have been favoured by William Cotton, Esq., F.R.S., with the view of some specimens of the bones of the Dinornis, very recently transmitted by his son the Rev. Wm. Cotton, M.A., from New Zealand, one of which is a fractured pelvis[1], corresponding in length and in so many other characters with *p* 5, as to lead to the conclusion that it belongs to the same species, and that the differences between them are attributable to sex.

These differences are the following. The bodies of the first two sacral vertebræ in Mr. Cotton's specimen, which I shall call *p* 6, are flatter on their under surface and broader; the form of the anterior articular surface of the first sacral vertebra more nearly resembles that in the largest fragment, *p* 1. The spines of the seven anterior vertebræ and the co-ascending plates of the iliac bones are less elevated in *p* 6. Thus, from the end of the transverse process of the sixth sacral vertebra to the summit of the ilium in *p* 5, is three inches ten lines, whilst in *p* 6 it is only two inches nine lines. The length of the part of the pelvis formed by the first seven sacral vertebræ is precisely the same in both. But whilst the height of *p* 5 is greater its breadth is rather less, especially immediately behind the acetabulum. The expanded horizontal thin plate of bone at the back part of the pelvis, between the diverging iliac bones, is well preserved in Mr. Cotton's specimen.

The breadth of this at the back part of the acetabula is five inches five lines; the breadth at the hinder end of the pelvis is three inches nine lines.

Of the two pelves which correspond in length and in most of the characters by which the one first described differs from *p* 4, we may regard the higher and narrower specimen, *p* 5, as belonging to the male, and the lower and broader one, *p* 6, to the female.

[1] Pl. XX *a*. fig. 1.

Vertebræ. (Plates XVIII. & XVIII *a.*)

Of the five vertebræ in the present collection, only one is of a size which surpasses in a marked degree that of the corresponding vertebra in a full-grown Ostrich; but all present much stronger proportions, especially of the spinous process, which is unusually robust. The largest vertebra[1], *v* 1, is a cervical one, probably from below the middle of the neck, anterior to those which are distinguished by a median inferior spine.

The following are its dimensions as compared with the twelfth cervical of a full-sized Ostrich:—

	Dinornis. In.	Lin.	*Struthio.* In.	Lin.
Length, at the middle of the terminal articular surfaces	2	9	2	2
Breadth, at the middle of the body	1	6		8
Height of the middle of the body	1	1		8
Height from anterior base of spine to the lower part of the anterior articular surface	1	8	1	0
Length of the neural arch	1	9	1	5
Breadth of do.	1	7	0	11

Every process and prominence of this specimen of the vertebræ of the Dinornis is broken off, with the exception of the right posterior oblique process. The texture everywhere presents large reticulate cancelli, which communicate with the outer surface by an orifice on each side the neural arch, behind the upper transverse process.

The body of the vertebra is square-shaped, with a broad and flat, or slightly concave under surface: the anterior part of this surface is divided from the anterior articular surface by a transverse channel, that surface being raised to a higher level. This structure does not exist in the corresponding vertebræ of the Ostrich: it is slightly indicated in those of the Apteryx. The spinal canal presents the usual infundibular expansion at both extremities: it is not larger at its middle contracted part than in the Ostrich. The remains of the base of the spinous process show this to have been almost square-shaped, and much thicker relatively as well as absolutely than in the Ostrich.

Two other vertebræ belong to the base of the neck, and correspond with those few cervical vertebræ at that part which, in most birds, have a median inferior process for the more advantageous origin of the great *longus colli anticus* muscle[2]. These two vertebræ must have come from the same or from closely contiguous parts of the neck; but they present differences of configuration and proportion which are incompatible with the identity of the species of Dinornis to which they respectively belonged.

Both manifest the generic massive proportions, the squareness of the body, the great

[1] Pl. XVIII. figs. 1, 2, 3.

[2] None of the cervical vertebræ present this character in the Ostrich or Emeu, but we find it in the last cervical of the Rhea, and in the last three cervicals of the Apteryx and Bustard.

breadth of its under surface, and the thick four-sided spinous process; but one (*v* 2)[1] is broader in proportion to its length than the other (*v* 3). The more slender vertebra[2] has a thicker spinous process, which, at the same time, is more compressed from behind forwards: the cavity behind the spine is deeper and more angular, as is also the notch between the posterior oblique processes. The anterior articular processes are raised higher above the body in the more robust vertebra, *v* 2 The anterior articular surface of the vertebra *v* 3 has a much less vertical extent than in the thicker vertebra; and the inferior spine (*h*) is narrower, but of greater antero-posterior extent, and is situated nearer the posterior part of the body. Both these vertebræ have the orifices at the sides of the neural arch which communicate with the interior loose cancellous structure. These are not present in the Apteryx, the corresponding vertebræ of which in other respects more nearly resemble the present in general form and proportions[3] than do those of the other existing *Struthionidæ*.

The vertebra *v* 4,[4] from New Zealand, transmitted to me by Dr. Richardson, the author of the 'Fauna Boreali-americana,' belongs to the same species as the vertebra *v* 2. It is either the first or second of the dorsal series: the inferior transverse processes manifest part of the concavity for the articulation of the head of the rib, and there is a spinous process (*h*) from the under surface of the body of the vertebra, which, as in the anterior dorsal of the Apteryx, is less broad and flattened than in the anterior cervicals.

Of the difference of the character of this vertebra, as compared with the corresponding one in the Ostrich, the figures[5] give a better idea than can be conveyed by verbal description. The upper transverse processes are continued, as in the first and second dorsals of the Apteryx, from the anterior part of the whole side of the neural arch, not, as in the Ostrich, from near the summit; these processes also, as well as the spinous process, are considerably thicker and stronger than in the Ostrich. In regard to the spinous process, the Dinornis, in the squareness of that part, differs as much from the Apteryx, in which the dorsal spines are compressed laterally and extended antero-posteriorly, as from the Ostrich.

The last vertebra, *v* 5, of the Dinornis in the present collection that remains to be noticed, is from the middle of the dorsal region: it belongs to a smaller species than the preceding; most probably to the *Din. didiformis*.

The body[6] is laterally compressed, and terminates below in a median carina, which has a concave outline: it has the characteristic shortness as compared with the breadth of the vertebræ in this genus; the anterior articular surface[7] is more concave from side to side, and the posterior surface more convex in the same direction than in the corresponding vertebræ of the Ostrich or Apteryx: both these surfaces have an unusual vertical diameter in proportion to their breadth.

[1] Pl. XVIII. figs. 4, 5, 6
[2] Pl. XVIII. figs. 7, 8, 9.
[3] Pl. XVIII. fig. 10.
[4] Pl. XVIII *a*. figs. 1, 2, 3.
[5] Pl. XVIII *a*. figs. 3 & 4.
[6] Pl. XVIII *a*. figs. 6 & 9.
[7] Pl. XVIII *a*. fig. 8.

The following are comparative admeasurements of this vertebra, and a corresponding one of a full-grown Ostrich:—

	Dinornis. In.	Lin.	*Struthio.* In.	Lin.
Length	1	9	2	0
Depth of anterior articular surface	1	0	0	$7\frac{1}{2}$
Breadth, including costal articulations	1	6	2	0
From the lower margin of posterior articular surface to the upper one of posterior oblique process	2	1	1	8

The spinous process of this vertebra is strong and square-shaped[1], and shows, like the preceding dorsal, that there was no blending together of the spines, nor any union by continuous splint-like ossifications, as in many birds, and especially in those that fly. The dorsal region in the skeleton of the Dinornis, by the intervals separating the spinous processes, must have resembled that in the large existing *Struthionidæ*, and have differed from the same part in the Apteryx, in which the dorsal spines are contiguous though not confluent; but the Dinornis surpassed all known birds in the thickness and squareness of its upright spinous processes. Of the length of these processes none of the five vertebræ afford an exact idea, all being more or less fractured.

The spinal canal is proportionally more contracted than in the Ostrich, or even in the Apteryx, where it is rather smaller than usual. This character in the Dinornis indicates, of course, a more slender spinal chord, in which respect it betrays a closer approach to the Reptilia. We may associate, with such a condition of the spinal marrow, less delicate perception, and less energetic muscular action; and the vertebræ thus confirm the induction from the texture of the femur, that the Dinornis was a more sluggish or less active bird than the Ostrich.

CONCLUSION.

Physiological indications of the nature and proportions of the Anterior or Pectoral Members.

Had the Dinornis wings? To this question I was led to give a negative reply after the examination of the first fragment of that bird's bone which came into my hands[2]. It has appeared strange and almost incredible to some, that the cancellous texture of the shaft of a thigh-bone should give, to speak mathematically, the presence or absence of wings. But if the negative had been premature and unfounded, a guess rather than a demonstration, its fallacy might have been exposed by the very next bone of a Dinornis transmitted from New Zealand. A bird of flight has as many wings as legs; it has two humeri as well as two femora, two radii as well as two tibiæ, two ulnæ as well as

[1] Pl. XVIII *a*. fig. 7.

[2] Absence of the organs of flight is the essential character of a Struthious bird, more especially of one "heavier than the Ostrich."

two fibulæ; the humerus and radius are usually, and the ulna is always, longer and larger than their analogues in the hind extremities; then also there are the two distinct carpal bones, a metacarpus and characteristically modified phalanges. The chances were thus greater that the next bone of an extremity discovered in the alluvium of New Zealand would have been one of the anterior members, had these been developed to serve as wings in the Dinornis. But what is the fact? Eighteen femora, eleven tibiæ and six tarso-metatarsi, with two toe-phalanges, have been consecutively discovered, and not a trace of any part of the osseous framework of a wing: not a fragment of scapula, of humerus, or of the bones of the forearm or hand.

The doctrine of chances thus adds its proof, were such required, to the inferences of physiological correlation, that the Dinornis had no wings. We may next inquire to what extent, short of the faculty of flight, the anterior or pectoral members were developed in this extinct genus, with the same confidence in the laws of correlation as a guide to the determination of this question.

The anterior members present very different degrees of arrested development in the different existing species of the *Struthionidæ*, and always retain, under even their most rudimental condition, the characteristic modifications of form and structure by which they are adapted to serve the office of flight in ordinary birds.

In these, as is well known, the body is made specifically lighter, and in a direct ratio with the powers of flight, by a proportionate extension of the air-cells through the muscular and osseous systems. A much greater proportion of the skeleton is permeated by air in the Swallow than in the Quail.

The Rhea and the Ostrich have the largest and most wing-like anterior members of all the *Struthionidæ*; they use them to aid in their swift progression: throwing their body forwards beyond the centre of support afforded by the hind legs, they partly sustain it by the flapping of the curtailed wings, whilst the legs, to the extent to which they are thus relieved from the act of sustaining, are free to exert additional force in propelling the body: and it may be said of the Ostrich at full speed that half the body flies and half runs. Now we find that in these semivolant *Struthionidæ* the warm and expanded air of the respiratory cavities is freely admitted into the bones of the skull, the vertebræ, the ribs, the sternum, the coracoids, the pelvis and the femora.

In the Emeu and Cassowary, whose pectoral members are much reduced in size, useless for anything like flight, and serving, so far as is known, only for some feeble actions of defence, the air is less freely admitted to the bones of the trunk, but still penetrates the femur.

In the Apteryx the rudimental wings are so minute, that the fact of their retention of the typical structure requires careful dissection for its demonstration: and in this species we find the lungs confined to the thoracic-abdominal cavity, and not extended into any part of the skeleton. The Dinornis presents an intermediate condition between the Apteryx and the Emeu in regard to the extension of the air-cells, which penetrated the vertebral column, as is shown by the pneumatic foramina in the vertebræ, but were not continued into the femora. We may infer, therefore, from the known relations of the development of the air-cells to that of the anterior members in existing *Struthionidæ*, that these were more rudimentary in the Dinornis than in the Emeu, but not quite so minute in proportion to the body as in the Apteryx. The size of the bones on this inference, even in the *Dinornis giganteus*, must have been small enough to prevent any surprise at their not having yet been recovered; especially when it is remembered that no part of the sternum nor any of the ribs, which doubtless surpassed the scapulæ and humeri in size, appear hitherto to have been found.

Stature of the different species of Dinornis. (Pl. XXX.)

The height of the hind leg of the *Dinornis giganteus* in the ordinary standing posture, from the sole of the foot to the upper ridge of the trochanter, being given by the bones of the pelvic extremity in the present collection, the total altitude of the bird may be approximatively determined by the analogies of the existing *Struthionidæ*. In these the neck varies slightly in its relative length, being longest in the Ostrich and Emeu, in which it includes 18 or 19 vertebræ, and shortest in the Cassowary and Apteryx, which have respectively 16 and 15 cervical vertebræ; but in all the species it is of sufficient length to enable them readily to pick up substances from the ground by a slight rotation or bending down of the trunk and pelvis upon the hip-joints.

In estimating the height of the *Dinornis giganteus* by the standard of the Ostrich, I have taken the latter at eight feet four inches, which is the altitude given by the skeleton of one with a tibia two feet in length[1]. The distal end of the metatarsus being raised in the living bird one inch and a half from the ground, the tarso-metatarsal bone, tibia and femur, placed at the angles which they form with one another in the standing posture, rise to the height of four feet four inches; and from the level of the highest point of the femur to the top of the head with the neck erect is four feet. The longest tibia of the *Dinornis giganteus*, with its extremities entire, measures two feet eleven inches: this bone articulated with a femur of sixteen inches and a tarso-metatarsal bone of eighteen inches in length, at angles corresponding to those in the Ostrich, and with an allowance of three inches for the natural angle of the toes and the callous integuments beneath the distal joint of the metatarsal bone, makes the height of the hind leg to the highest point of the femur five feet six inches: from the level of this point to the top of the head, supported upon an erect neck of the same proportions as in the Ostrich, is five feet, making the total height of the *Dinornis giganteus* ten feet six inches. If the tarso-metatarsal bone of the Dinornis had borne the same proportion to the tibia as in the Ostrich, its height would have been nearly twelve feet, but the acquisition of

[1] The tibiæ of mature specimens of the Ostrich in the Museum of the Royal College of Surgeons measure respectively 1 foot 8 inches, 1 foot 9½ inches, and 1 foot 11 inches in length. The accurate and learned authors of the 'Gardens and Menagerie of the Zoological Society' state that the Ostrich "is generally from six to eight feet in height."—Vol. ii. p. 51.

the tarso-metatarsal belonging to the largest tibia fortunately prevented this error of exaggeration.

But since the Cassowary and Apteryx, as compared with the Ostrich and Emeu, combine shorter tarso-metatarsals with their shorter necks, the Dinornis is much more likely to have resembled these birds than the Ostrich in the proportionate length of its neck, and we know that it resembled the Apteryx much more than the Ostrich in the robust proportions of the cervical vertebræ. In the Apteryx, however, the peculiar length of the bill compensates for the relative shortness of the neck; and until we have proof to the contrary, we must suppose the Dinornis to have had a bill of the ordinary proportions which it presents in the large existing *Struthionidæ*. I, therefore, conceive the Cassowary to offer the best term of comparison by which to calculate the height of the Dinornis. In the skeleton of a full-grown Cassowary[1] the tarso-metatarsal bone measures eleven inches in length: allowing an inch for the callous integuments beneath its distal articulation, the tibia and femur, articulated at the angles natural in the standing posture, rise to the height of two feet nine inches. From the level of the top of the trochanter to the top of the cranial crest is two feet three inches, and to the base of the crest two feet. We have no evidence that the Dinornis had that peculiar defence upon the head, and therefore, from the ground to the summit of the trochanter of the *Dinornis giganteus* being five feet six inches[2], from this level to the top of the head, according to the proportion of the uncrested Cassowary, would be four feet, making the total altitude nine feet six inches. Thus, if we take the average of the altitudes of the *Dinornis giganteus*, as given by the analogies of the existing *Struthionidæ*, we are compelled to restrict our ideas of its height in the ordinary upright posture to ten feet.

The *Dinornis struthoides*[3], with a femur of eleven inches, a tibia of twenty-two inches, and a tarso-metatarsus of twelve inches in length, must have stood, according to the analogies of the Cassowary, six feet nine inches in height; according to those of the Ostrich, seven feet four inches: we may therefore regard its height to have not exceeded seven feet, or to have been about equal to that of a moderate-sized Ostrich, but of a more robust and stronger build. The fragment of the femur first described by me in 1839 belongs to this species.

The *Dinornis didiformis*, with a tibia as long as that of the Cassowary, viz. sixteen inches, but with a femur of eight inches and a tarso-metatarsus of only seven inches in length[4], would, by the analogy of the Cassowary, be a little under four feet in height, or of intermediate size between the Cassowary and the Dodo.

The femur of nine inches in length, with similar proportions of the tibia and metatarsus, which latter would probably be relatively longer, gives the height of five feet to the species which, from its similarity in size to the Emeu, I have called *Dinornis*

[1] Pl. XXX. fig. 2. [2] *Ib.* fig. 5. [3] *Ib.* fig. 3.

[4] *Ib.* fig. 1. The tarso-metatarsal bone of the *Dinornis didiformis* in Mr. Cotton's collection measures seven inches ten lines in length (Pl. XX *a.* fig. 2.); it is in other respects identical in character with the analogous bones described in the text, and indicates a sexual superiority of size.

dromæoides. The tibia of the *Dinornis ingens*[1] indicates that species to have attained the height of nine feet.

Comparison of the bones of the feet of the Dinornis *with the American Ornithichnites.*

In 1836 Prof. Hitchcock[2] published his remarkable discovery of impressions in the New Red Sandstone of the valley of the river Connecticut, Massachusetts, which he conceived to be the foot-prints of birds, the largest belonging to a species with three toes, surpassing the Ostrich in size. The epoch of these impressions is as ancient as that of the Cheirotheria or Labyrinthodont footsteps in Europe, and more ancient than those of the oolites and lias, from which the remains of our most extraordinary extinct reptiles have been obtained: but no fossil bones of birds have been found associated with the Labyrinthodont and Thecodont reptiles, nor with those of the lias or oolites, the Pterodactyles of which were once mistaken for birds. The Wealden is the oldest formation in which true ornitholithes have hitherto been discovered. The ancient foot-prints of the Connecticut sandstones were for the most part supposed to be those of *Grallæ*; but the high geological antiquity of those sandstones, and the inferences which might be deduced from the low character of the air-breathing animal creation, as indicated by fossil bones, of the condition of the atmosphere during the deposition of the oolites, lias and new red sandstones, led me to express a doubt in my report on British Fossil Reptiles whether foot-prints alone were adequate to support the inference that the animals that impressed them actually possessed the highly-developed respiratory organization of a bird of flight[3]. One could hardly in fact venture to reconstruct in imagination the stupendous bird which, on Dr. Hitchcock's hypothesis, must have left the impressions called *Ornithichnites giganteus*; for, before 1843, the only described relic of the extinct New Zealand bird did not warrant the supposition of a species larger than the Ostrich[4].

The species of *Dinornis*, in fact, to which that relic belonged, we now know not to have exceeded seven feet in height, which is the average stature of the Ostrich. But the bones of the *Dinornis giganteus* subsequently acquired demonstrate the existence, at a comparatively recent period, of a bird whose tridactyle foot-prints, as will be presently shown, surpassed the *Ornithichnites giganteus* of Prof. Hitchcock.

The length of this foot-print from its hind part to the extremity of the impression of the claw of the middle toe is sixteen inches; the breadth of the hind part is four inches six lines. The toes were broad and thick, and we may plainly discern that the bird supported itself, like the Ostrich, upon the under surface of the toes, from their extremities to the cushion beneath the distal end of the proximal phalanges; and that in making the impression, the foot did not quite sink as far as the end of the metatarsal bone.

[1] Pl. XXX. fig. 4.
[2] American Journal of Science and Arts, vol. xxix. No. 2.
[3] Report on British Fossil Reptiles, Part II., Trans. British Association, 1841, p. 203.
[4] Zoological Proceedings, November 1839, p. 170.

The length of a corresponding impression of the foot of the Ostrich is eight inches; the breadth of the posterior part of the impression three inches; the breadth of the distal end of the tarso-metatarsal bone two inches and a half. According to these proportions, the breadth of the distal end of the tarso-metatarsal bone of the tridactyle bird that impressed the *Ornithichnites giganteus* must have been three inches nine lines; but the breadth of the distal end of the tarso-metatarsus of the *Dinornis giganteus* is five inches. According, therefore, to the proportions of the *Ornithichnites giganteus*, the breadth of the hind part of the foot-print of the *Dinornis giganteus* must have been six inches, and its length twenty-one inches and a half.

The genus Dinornis was characterized by a relatively broader foot than the Ostrich, as we know by the tarso-metatarsal bones; and this bone in the *Dinornis struthoides*, the third species in point of size, indicates that its bulky body was supported by feet calculated to leave impressions nearly as large as those of the *Ornithichnites giganteus*. That the toes were as long in proportion to the breadth of the metatarsal bone as in the Ornithichnites, is shown by the two phalanges transmitted by Mr. Williams, the description of which I have reserved for this place.

The largest of these phalanges is $3\frac{1}{4}$ inches long and $1\frac{1}{2}$ inch broad across the proximal joint. This does not present the median vertical ridge which the corresponding groove in the articular surface of the metatarsal indicates the proximal phalanx to possess, and I regard it, therefore, to be a second phalanx, which, as in the middle toe of the Ostrich, would then differ from the first phalanx in the equable concavity of the proximal articular surface. In the second or outer toe of the Ostrich the median eminence is wanting on the proximal end of the first phalanx, but the want of symmetry in that bone shows that it cannot be the analogue of the phalanx of the Dinornis in question, which is almost quite symmetrical. From this character it may be referred to the middle toe: compared with the second phalanx of that toe in a full-grown Ostrich it is relatively longer, less depressed or flattened, the depth of the bone being equal to its breadth except at the distal articulation, which nevertheless is much less expanded and depressed than in the Ostrich. In this bird the length of the second phalanx of the middle toe is $2\frac{1}{4}$ inches, the breadth of the distal end is $1\frac{1}{2}$ inch, and its depth at the middle of the bone 8 lines. In the phalanx of the Dinornis the breadth of the distal end is $1\frac{1}{4}$ inch, its depth at the middle 10 lines. The size of the phalanx of the Dinornis, regarded as the second of the middle toe, agrees well with that of the tarso-metatarsal of the *Dinornis struthoides*. The length of the second phalanx in the *Ornithichnites giganteus* is indicated by the articular eminences in the cast of that impression, and it is a little shorter than the phalanx of the Dinornis above described.

The smaller of the two phalanges has an unsymmetrical figure, and its proximal articular concavity is continuous with an oblique notch which divides the lower border into two tuberosities. This structure is slightly indicated at the corresponding part of the proximal phalanx of the outer toe in the Ostrich, and in the Bustard is as strongly marked in the proximal phalanx of both the outer and inner of the three toes as in the phalanx of the Dinornis. This phalanx measures one inch ten lines in length, one inch two lines across the proximal end, and ten lines across the distal end: the articular surface here is impressed by a vertical groove, as in the proximal phalanges of the outer and inner toes in the Bustard, and it agrees in its general figure with that of the outer toe of the left foot, but is much thicker in proportion to its length. The proximal articulation matches in size with, but is not adapted by its configuration to, the outer trochlea of the trifid metatarsal of the *Dinornis didiformis*. The foot-print of this species was probably about the size of the *Ornithichnites tuberosus* of Prof. Hitchcock.

From the foregoing comparison of the bones of the feet in the different species of Dinornis with the impressions left by the ancient extinct birds of the American continent, it must not, however, be concluded that these were species of Dinornis. Agreement in the size of the foot and number of the toes does not constitute specific or even generic identity in Ornithology, as the living Emeu, Rhea and Cassowary testify; and though we may admit that the discovery of tridactyle terrestrial birds of a size more gigantic even than that indicated by the *Ornithichnites giganteus* and *Ornithichnites ingens* tends greatly to remove the scepticism with which such evidences of the extinct animals of the Triassic period had been previously received, yet the recognized succession of varying vertebrated forms in the interval between that period and the present forbids the supposition that the same species or genus of birds could have maintained its existence throughout the several great changes which the earth's surface has undergone during that vast lapse of time.

We see, in fact, how diversified are the few existing forms of *Struthionidæ*: almost every species now represents a distinct genus. We know that this order has suffered greater diminution within the time of man than any other in the class of Birds, perhaps than any other in the whole animal kingdom. What, then, may not have been the extent and variety of the wingless terrestrial birds in times anterior to man's dominion over the earth!

Already the heretofore recorded number of the *Struthionidæ* is doubled by the six species of Dinornis determined or indicated in the foregoing pages; and both the Maori tradition of the destruction of the 'Moa'[1] by their ancestors, and the history of the extirpation of the Dodo by the Dutch navigators in the Isles of Maurice and Rodriguez, teach the inevitable lot of bulky birds unable to fly or swim, when exposed, by the dispersion of the human race, to the attacks of man. We may, therefore, reasonably anticipate that other evidences await the researches of the naturalist, which will demonstrate a further extent of the Struthious order of Birds anterior to the commencement of the present active cause of their extinction.

And since the texture of the bones of the former gigantic tridactyle *Struthionidæ* of New Zealand proves that they resembled the Apteryx, in the comparatively low

[1] The Maoris or Aborigines of New Zealand call the Dinornis 'Moa' or 'Movie.'

and reptile-like condition of the respiratory apparatus, we are thereby further justified in admitting the evidence of the co-existence of similar apterous and low organized birds with the cold-blooded and slower-breathing Ovipara, which swarmed in such plenitude of development and diversity of forms during what has been termed the 'Age of Reptiles.'

The remarkable geographical distribution of the birds of the Struthious order, which have no power of transporting themselves to distant isles or continents, either through the air or the ocean[1], irresistibly leads us to speculate on the cause of that distribution, and its connexion with the former extent and importance of the wingless terrestrial birds. Hereupon it may first be remarked that those species, now in existence, which have the least restricted powers of locomotion, enjoy the most extensive range for their exercise.

The Ostrich is spread over nearly the whole of Africa, from the Cape to the deserts of Arabia; beyond which the species is unknown. The Rhea ranges over a great part of the southern extremity of the Western hemisphere. To the Emeu has been assigned the vast mainland of Australia. The heavier Cassowary is limited to a few of the islands of the Indian Archipelago. The Dodo appears to have been confined to the Mauritius and the small adjoining Isle of Rodriguez. The Apteryx still lingers in New Zealand, where alone any specimens of that most anomalous species of the Struthious order have been discovered.

New Zealand was, also, at one period, the seat of a seventh genus of *Struthionidæ*; and it is worthy of remark that the Fauna of no other island, nor of any of the great continents, has yet furnished an analogous example of two distinct genera of that group of birds. Moreover the most gigantic as well as the most diminutive species of the wingless group—always to Ornithologists most remarkable for the great size of its species—formerly occupied their place amid the fern-thickets and turbaries of New Zealand. And, again, the number of the species of *Struthionidæ* in this island equalled that in all the rest of the world, as registered in the catalogues of Ornithology.

Now, since all the larger existing Struthious birds derive their subsistence from the vegetable kingdom, we may hope to receive from the botanist an elucidation of the circumstances which favoured the existence of so many large birds of this order in the remote and restricted locality where alone their remains have hitherto been found. It seems, at least, most natural to suppose that some peculiarity in the vegetation of New Zealand adapted that island to be the seat of apterous tridactyle birds, so unusually numerous in species and some of them of so stupendous a size.

The predominance of plants of the Fern-tribe, and the nutritious qualities of the roots of the species most common in New Zealand, are the characteristics of its Flora which

[1] The Rhea and Emeu have been seen to take water for the purpose of crossing rivers and narrow channels of the sea; but almost the entire body sinks below the surface, and their progress is slow, as might be anticipated from the absence of the swimming-webs in their feet. See Darwin, 'Voyage of the Beagle,' vol. iii. p. 105.

appear to have been the conditions of the former peculiarities of the Fauna of this island. Some at least of the characters of the skeleton of the Dinornis may well have related to rhizophagous habits. The unusual strength of the neck indicates the application of the beak to a more laborious task than the mere plucking of seeds, fruits, or herbage. The present small Apteryx of New Zealand has a relatively stronger neck than any of the existing *Struthionidæ*, in relation to the needful power of perforating the earth for the worms and insects which constitute its food. Such small objects cannot be supposed to have afforded sustenance to the gigantic *Dinornithes*: but the still more robust proportions of their cervical vertebræ, and especially of their spinous processes,—so striking when contrasted with the corresponding vertebræ of the Ostrich or Emeu,—may well have been the foundation of those forces by which the beak was associated with the feet in the labour of dislodging the farinaceous roots of the ferns that grow in characteristic abundance over the soil of New Zealand[1].

The great strength of the leg, and especially of the metatarsal segment, which is shortened, as in the burrowing Apteryx, almost to the gallinaceous proportions, must have had reference, especially in the less gigantic species, to something more than sustaining and transporting the superincumbent weight of the body, and this additional function is indicated by both the analogy of the Apteryx and the Rasorial birds to be the scratching up the soil.

Thus far, at least, the positive facts justify the attempt to restore, and, as it were, to present a living portrait of the long-lost Dinornis; and, without giving the rein to a too exuberant fancy, we may take a retrospective glance at the scene of a fair island, offering, by the will of a bountiful Providence, a well-spread table to a race of animated beings peculiarly adapted to enjoy it; and we may recall the time when the several species of Dinornis ranged the lords of its soil—the highest living forms upon that part of the earth. No terrestrial Mammal was there to contest this sovranty with the feathered bipeds before the arrival of man[2].

Without laying undue stress on the native tradition of the gigantic Eagle or 'Movie,' cited by Mr. Rule[3], or on that of the great creature of the cavern, called 'Moa,' which first attracted the attention of Mr. Williams to the remains of the Dinornis; and admitting with the cautious scepticism due to second-hand testimony, the tale of the still-existing nocturnal gigantic bird which scared the whaling seamen on the hill at Cloudy

[1] "New Zealand is favoured by one great natural advantage, namely, that the inhabitants can never perish from famine. The whole country abounds with fern; and the roots of this plant, if not very palatable, yet contain much nutriment." Voyage of the Adventure and Beagle, vol. iii. 'Darwin,' p. 504.

[2] Mr. Darwin says, "It is a most remarkable fact that so large an island, extending over more than 700 miles in latitude, and in many parts 90 miles broad, with varied stations, a fine climate, and land of all heights from 14,000 feet downwards, with the exception of a small rat, should not possess one indigenous mammal."—*Loc. cit.* p. 511.

[3] Polytechnic Journal, July 1843.

Bay,—the evidence of the chemical condition of the bones themselves[1], and their alluvial bed, favour the hypothesis of their comparatively recent date. It is not altogether improbable that the species of Dinornis were in existence when the Polynesian colony first set foot on the island; and, if so, such bulky and probably stupid birds, at first without the instinct and always without adequate means of escape and defence, would soon fall a prey to the progenitors of the present Maoris.

In the absence of any other large wild animals, the whole art and practice of the chase must have been concentrated on these unhappy cursorial birds[2]. The gigantic Dinornis, we may readily suppose, would be the first to be exterminated: the strength of its kick would less avail, than its great bulk would prejudice its safety by making its concealment difficult; at all events, the most recent-looking bones are those of the smaller species. The closely allied, but comparatively diminutive Apteryx still survives by virtue of its nocturnal habits and subterraneous hiding-place, but in fearfully diminished and rapidly diminishing numbers. When the source of animal food from terrestrial species was reduced by the total extirpation of the genus *Dinornis* to this low point, then may have arisen those cannibal practices which, until lately, formed the opprobrium of a race of men in all other respects much superior to the Papuan Aborigines of the neighbouring continent of Australia, and very little inferior to the Polynesian natives of the most favoured islands of the Pacific.

[1] I have been favoured with the following analyses by my friend Thomas Taylor, Esq., author of the Catalogue of the Calculi and other Animal Concretions in the Museum of the Royal College of Surgeons:—

"*Recent Tibia of Ostrich.*	
Animal matter	26·51
Phosphate of lime	65·69
Phosphate of magnesia	0·95
Carbonate of lime	6·22
Sulphate and carbonate of soda, with trace of muriate	0·12
Sulphate of lime, a trace.	
Fluorine, a trace.	
	99·49

Fossil Femur of Dinornis didiformis.	
Animal matter	25·99
Phosphate of lime with phosphate of magnesia	66·19
Carbonate of lime	4·51
Peroxide of iron	2·81
Alumina	0·22
Sulphate, carbonate, and muriate of soda	0·32
Sulphate of lime, a trace.	
Fluorine, a very distinct trace.	
	100·04"

The subjoined comparative analysis, kindly undertaken by Dr. G. Day, also shows the large proportion of animal matter in the bones of the Dinornis:—

	"*Recent femur of Ostrich.*	*Femur of Dinornis struthoides.*
Animal matter	34·86	37·86
Inorganic matter	65·65	62·94
	100·00	100·00"

The superabundance of animal matter in the bone of the extinct bird depends upon its being a marrow-bone, whilst that of the Ostrich contains air.

[2] As the Maoris prize the skin and feathers of the Apteryx for the manufacture of ornamental robes, it might be worth inquiry whether any of the natives preserve remains of their ancestors' dresses composed of feathers of unknown and larger species of birds. Such relics of a Dinornis might in this way be recovered.

ADDENDUM.

J. R. Gowen, Esq., a Director of the New Zealand Company, has obligingly forwarded to me the subjoined indication of a further discovery of the bones of the Dinornis, from a new locality in New Zealand:—

"Extract of a letter from Colonel William Wakefield to J. R. Gowen, Esq., dated Wellington, 19th September, 1843.

"I received lately your letter respecting the Moa, with Professor Owen's notice. I have taken steps to procure some of the bones, which are much larger than the one represented in the sketch. The Rev. Mr. Taylor, of Wanganui, has a large collection of these bones, found in a river between that place and New Plymouth. I have heard several stories of live Moas having been seen; one, that the enormous size (higher than our one-storied houses) frightened the person, an Englishman, who was going to shoot it; but I don't believe any one has seen a live one lately. I intend to make further inquiries amongst the old natives, and send you all I can collect of bones."

DESCRIPTION OF THE PLATES.

PLATE XVIII.

Cervical vertebræ, natural size.

Fig. 1. Front view of a middle cervical vertebra of the *Dinornis giganteus*.
2. Side view of the same, showing the posterior articular process and the outline of the right inferior tuberosity, restored, at *h*.
3. Base view of the same; *h h*, the fractured inferior tuberosities.
4. Side view of an inferior cervical vertebra of a smaller species of *Dinornis* (*Din. struthoides?*): the antero-posterior extent of the single inferior spine is indicated at *h*.
5. Upper view of the same vertebra.
6. Front view of the same vertebra.
7. Side view of a corresponding cervical vertebra of another species of *Dinornis*, of equal size with the preceding: the antero-posterior extent of the inferior spinous process is indicated at *h*.
8. Upper view of the same vertebra.
9. Front view of the same vertebra.
10. Upper view of the thirteenth cervical vertebra of the *Apteryx australis*.

PLATE XVIII *a*.

Dorsal vertebræ, natural size.

Fig. 1. Side view of an anterior dorsal vertebra, of apparently the same species of *Dinornis* as that to which the cervical vertebra Fig. 4 in Plate XVIII. belonged: *c*, the costal articulation; *h*, the strong inferior spinous process.

2. Upper view of the same vertebra.
3. Front view of the same vertebra.
4. Front view of a corresponding dorsal vertebra in an Ostrich: *h*, the inferior spinous process.
5. Front view of the thirteenth cervical vertebra in the Apteryx: *h*, the inferior spinous process.
6. Side view of a middle dorsal vertebra of a smaller species of *Dinornis* (*Din. dromæoides*?): *c*, the costal articulation.
7. Upper view of the same vertebra.
8. Front view of the same vertebra.
9. Under view of the same vertebra.

PLATE XIX.

Front or under views of the Pelvis of three species of Dinornis and of the Ostrich, all reduced to one-fourth the natural size.

Fig. 1. Anterior sacral vertebræ of *Dinornis giganteus*.

2. Pelvis of *Dinornis dromæoides*.
3. Anterior portion of pelvis of *Dinornis didiformis*.
4. Entire pelvis of the Ostrich (*Struthio Camelus*).

The following letters indicate the same parts in each figure:—

a. Anterior sacral vertebra, and its costal articular surfaces in figs. 2 & 3.
b. Middle sacral vertebræ without inferior transverse processes.
c. Os ilium.
d. Os pubis.
e. Os ischium.

PLATE XX.

Back and side views of Pelvis of different species of Dinornis, one-fourth the natural size.

Fig. 1. Right os innominatum of *Dinornis giganteus*.

2. Pelvis of *Dinornis dromæoides*.

Fig. 3. Back or upper view of the same pelvis : *b*, the confluent spines of the posterior sacral vertebræ.

4. Side view of pelvis of *Dinornis didiformis*.
5. Fragment of the pelvis of *Dinornis struthoides*.
   f. The acetabulum.

PLATE XX *a*.

Fig. 1. Pelvis of male *Dinornis didiformis*, natural size.

2. Tarso-metatarsal bone of ditto, ditto.

PLATE XXI.

Femora, natural size.

Fig. 1. Back view of femur of *Dinornis ingens*.

2. Lower or distal end of femur of *Dinornis ingens*.
3. Back view of femur of *Dinornis struthoides*.
4. Distal end of femur of *Dinornis dromæoides*.

PLATE XXII.

Femur of *Dinornis dromæoides*, natural size.

Fig. 1. Front view.

2. Back view: *d*, ridge above the internal condyle; *e*, fossa above the external condyle.

PLATE XXIII.

Fig. 1. Side view of femur of a young *Dinornis struthoides*.

2. Side view of femur of *Dinornis dromæoides*.

PLATE XXIV.

Femur of *Dinornis didiformis*, natural size.

Fig. 1. Front view.

2. Back view: *d*, tuberosity above the internal condyle; *e*, fossa above the external condyle.
3. Distal end.

PLATE XXV.

Front views of tibiæ, natural size.

Fig. 1. Tibia of *Dinornis ingens*.

Fig. 2. Distal trochlea of ditto.
3. Tibia of *Dinornis didiformis.*
4. Distal trochlea of ditto.
5. Tibia of *Dinornis otidiformis.*
6. Distal trochlea of ditto.

PLATE XXVI.

Back views of tibiæ, natural size.

Fig. 1. Tibia of *Dinornis ingens.*
2. Proximal end of ditto.
3. Tibia of *Dinornis didiformis.*
4. Proximal end of ditto.
5. Tibia of *Dinornis otidiformis.*
6. Proximal end of ditto.

The following letters indicate the corresponding parts in each figure:—
a. Concavity anterior to the articular condyles.
b. Process for the attachment of the rotular ligament.
c. Anterior crista at the proximal end.
d. Ridge for the attachment of the fibula.
e. Internal condyle or prominence of the distal trochlea.

PLATE XXVII.

Tarso-metatarsal bones, natural size[1].

Fig. 1. Front view of the tarso-metatarsal of *Dinornis giganteus.*
2. Front view of the tarso-metatarsal of *Dinornis struthoides.*
3. Front view of the tarso-metatarsal of a female (?) *Dinornis didiformis.*
4. Back view of ditto.
5. Upper or proximal end of ditto: *a*, the outer concavity; *b*, the inner one.
6. Lower or distal end of ditto.

PLATE XXVIII.

Tarso-metatarsal bones, half the natural size.

Fig. 1. Front view of the metatarsus of a young Ostrich (*Struthio Camelus*).
2. Proximal ends of the three metatarsal bones, which are still separate at this part.
3. Front view of the metatarsus of a young *Dinornis giganteus.*

[1] The mirror was not used in drawing these bones; they appear, therefore, to belong to the right leg.

Fig. 4. Proximal ends of the three metatarsal bones not united together at this part.
5. Side view of the tarso-metatarsal bone of the *Dinornis struthoides*.
6. Side view of the tarso-metatarsal bone of the *Dinornis didiformis*.
7. A transverse section of ditto, at the part corresponding with the three separate metatarsals of the young *Dinornis giganteus*, fig. 4.

PLATE XXIX.

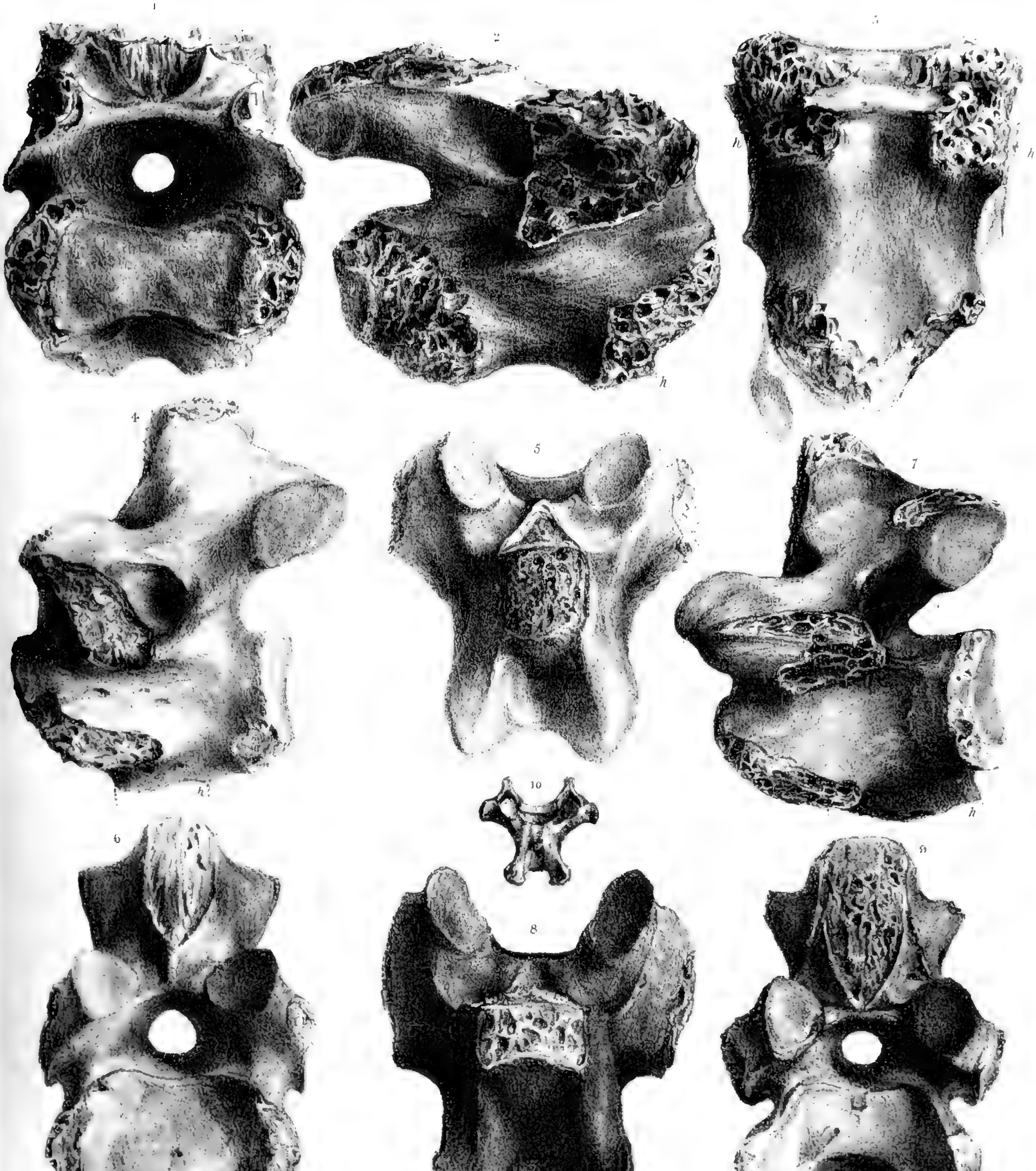
Internal structure of certain bones.

Fig. 1. Section of the femur of *Dinornis didiformis*, natural size: *h*, an accidental depression at the back of the cervix, not leading into the interior medullary cavity; *i*, the depression in the popliteal space, without any opening into the interior of the bone.
2. Section of the femur of an Ostrich, half the natural size: *h*, the orifice and oblique canal conducting into the interior pneumatic cavity of the bone; *i*, the outlet of the same cavity in the popliteal space.
3. Section of the femur of the *Apteryx*, in which no air is admitted into the medullary cavity; natural size.
4. Section of the tibia of the *Apteryx*, natural size.
5. Section of the tarso-metatarsal bone of *Dinornis didiformis*, natural size: *h*. the obliterated line of union of the tarsal epiphysis.

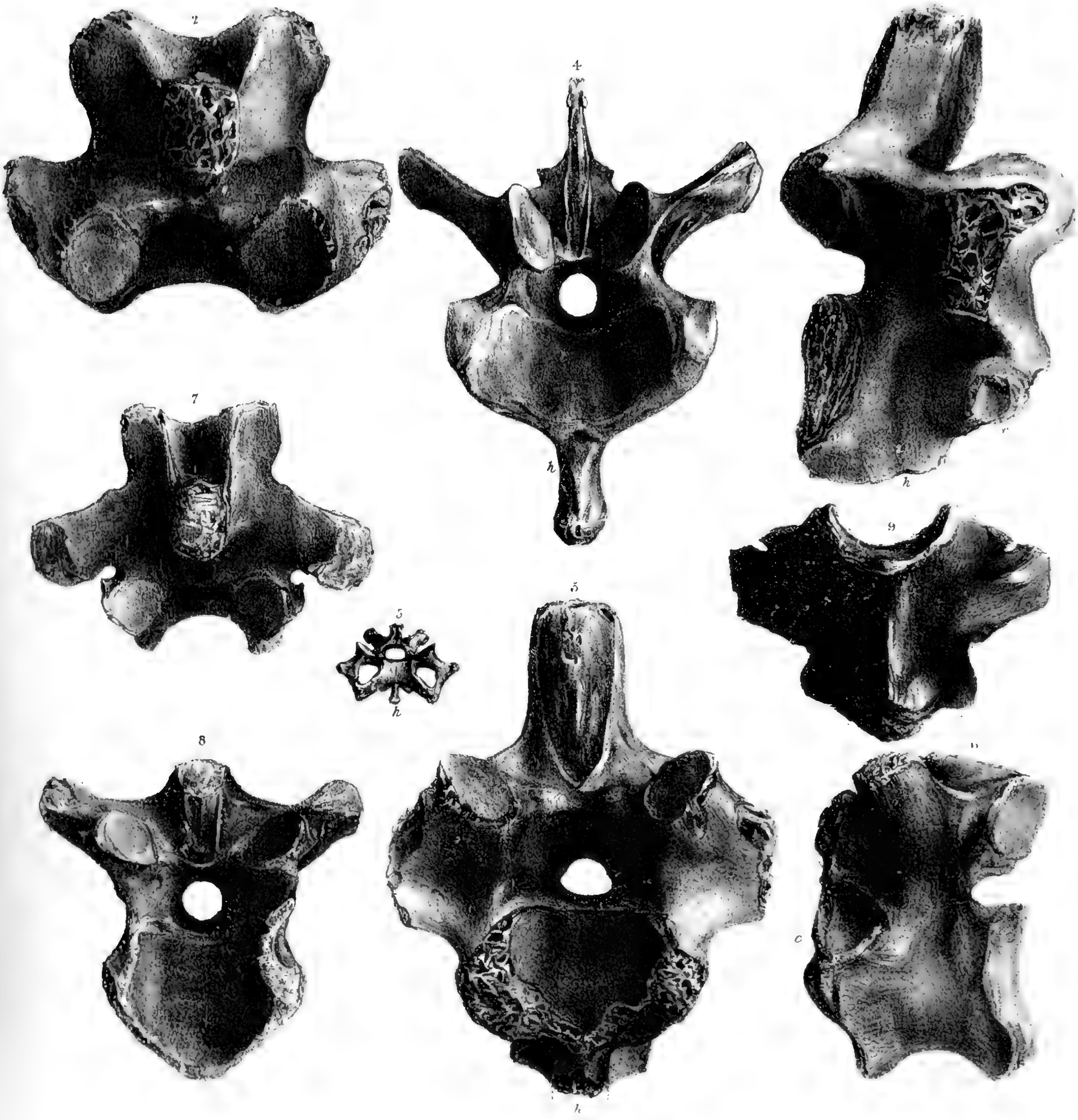
PLATE XXX.

Restoration of the *Dinornis giganteus*, and scale of altitude of that and other species, according to the standard of the Cassowary.

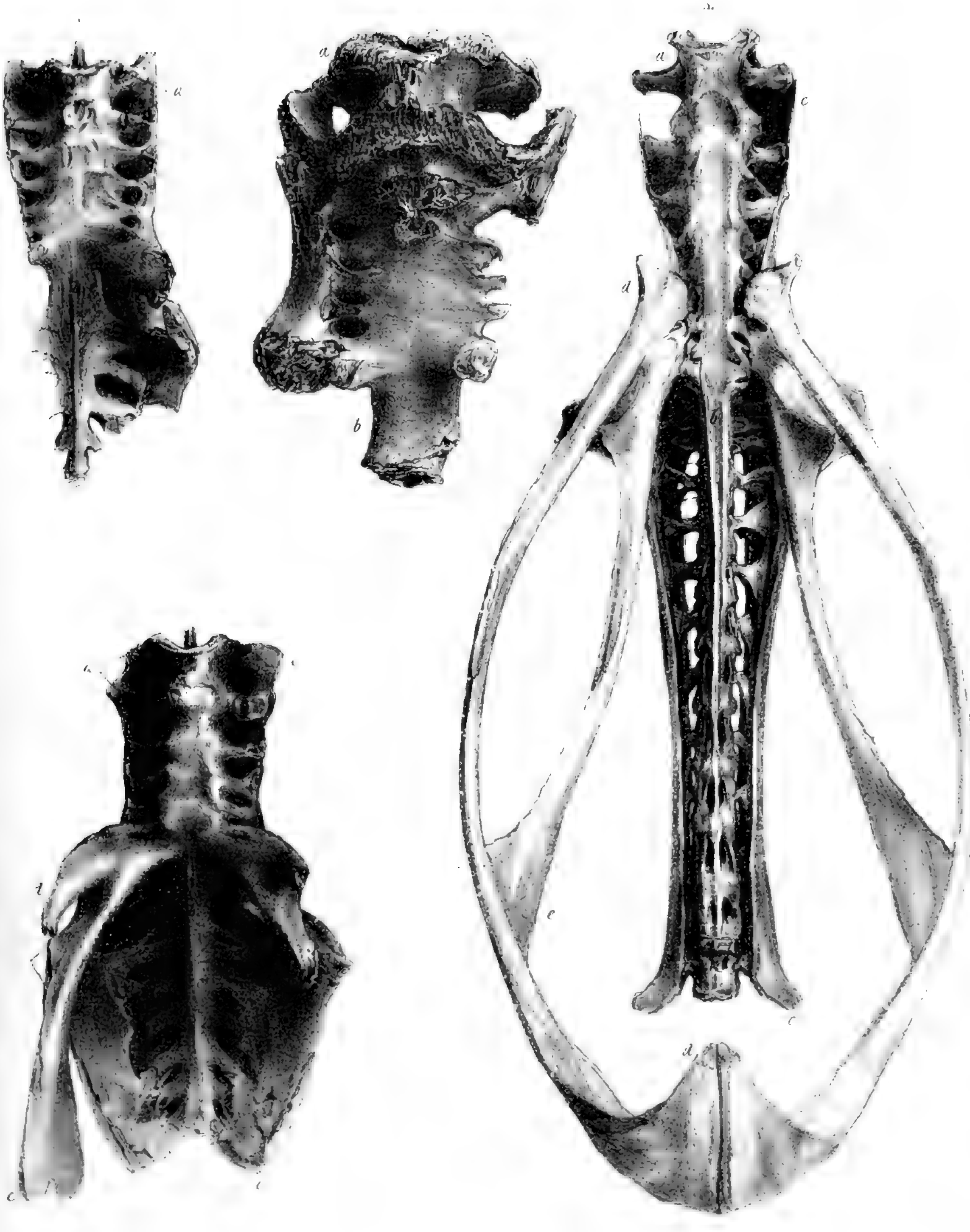
Fig. 1. The three principal bones—femur, tibia, and tarso-metatarsus—of the hind extremity of *Dinornis didiformis*.
2. Skeleton of *Casuarius galeatus* (Pander & D'Alton).
3. The femur, tibia, and tarso-metatarsus of *Dinornis struthoides*.
4. The femur, tibia, and tarso-metatarsus of the *Dinornis ingens*.
5. The pelvis, femur, tibia, tarso-metatarsus, and restored outline of the *Dinornis giganteus*.

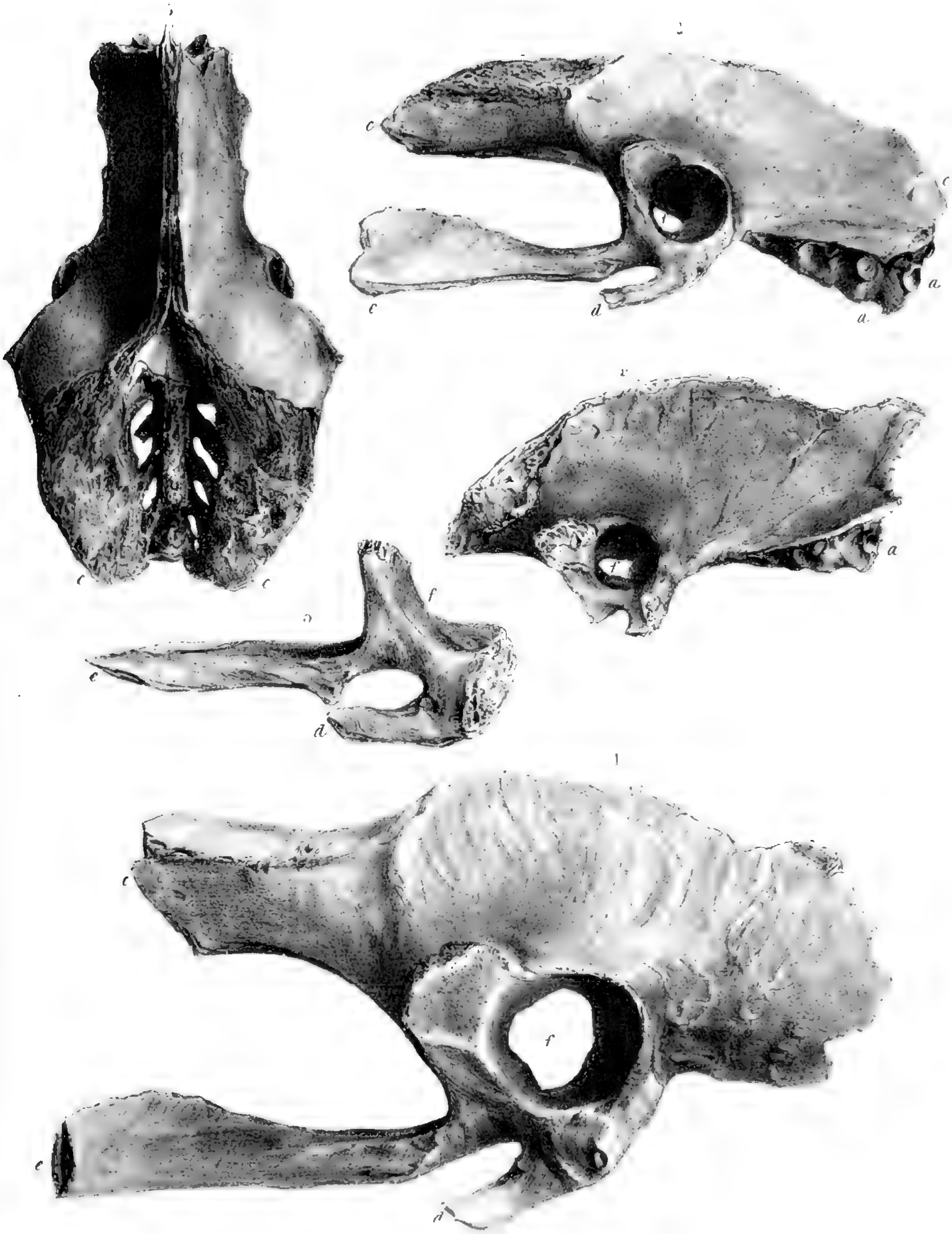


J. Erxleben Zinc.



1.3.6.9. Dinornis ___ 4. Struthio ___ 5 Apteryx.





J. Erxleben Zinc.

⅓d Nat. Size

Nat. Size

Printed by C. Hullmandel

Dinornis didiformis.

Drawn from Nature by G. Scharf. Printed by C. Hullmandel.

Fig. 1 & 2. Dinornis ingens Fig 3. Din. struthoides. Fig 4 Din dromioides

Nat Size

Lithog from Nature by G. Scharf

Printed by Hullmandel

Dinornis dromioides.

Nat. Size.

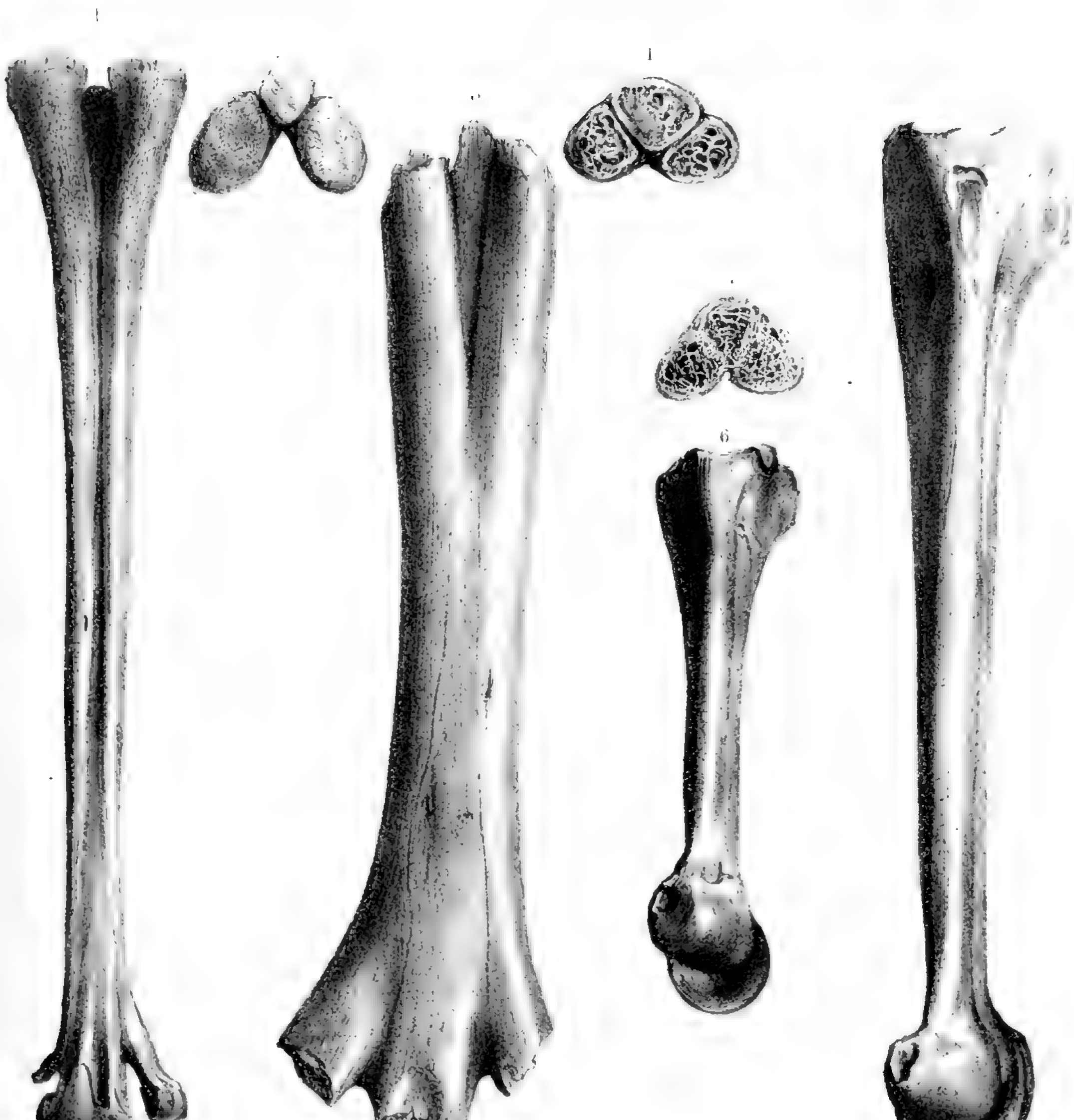
Lithog. from Nature by G. Scharf. Printed by C. Hullmandel.

1. Dinornis struthoides, juv. 2. Din: dromioides.

Lithog from Nature by G. Scharf

Printed by C. Hullmandel

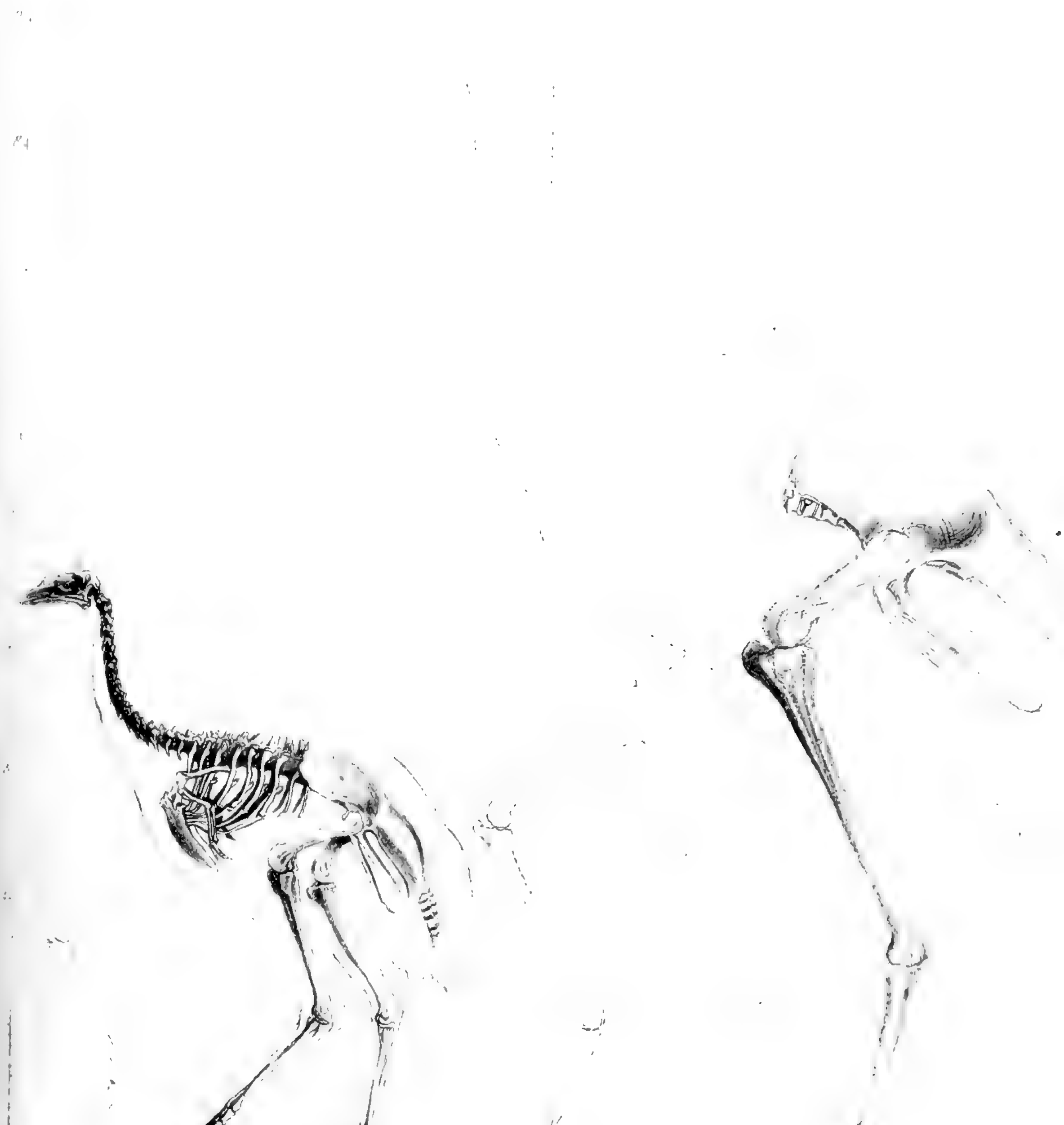
Dinornis didiformis.



1 & 2. Struthio — 3. Dinornis

½ Nat. Size.

1
2
h
½ Nat Size



Dinornis 1. didiformis. _ 3. struthoides _ 4. ingens 5. giganteus.
2. Casuarius galeatus

XI. *On the Anatomy of the* Apteryx Australis, *Shaw.* Part II. (Myology.)

By RICHARD OWEN, *F.R.S., F.Z.S., &c. &c.*

Read February 22, 1842.

THE former part of this memoir on the Anatomy of the *Apteryx australis*[1] includes the description of the osteology and splanchnology, with the male organs of generation; the present part is devoted to the illustration of the myology of the same rare and anomalous bird. The specimens which I have dissected for the muscles were afforded me by the Earl of Derby, President, and by Mr. George Bennett, F.L.S., of Sydney, Corresponding Member of the Zoological Society, to whom I am much indebted for such valuable opportunities of completing this monograph on the Apteryx.

The muscular system offers a subject of peculiar interest to the Comparative Anatomist when studied in a species which, in its general proportions and habits of life, deviates in so extreme a degree from the rest of the circumscribed and well-marked class to which it belongs. It is also a department of the anatomy of birds which, from the minute attention and length of time required for its accurate investigation, has been commonly passed over in anatomical monographs of species, but which the rarity of the *Apteryx* and the excellent state of preservation of the specimens dissected have both stimulated and enabled me to pursue with a degree of care which will be found, I trust, when tested by subsequent dissection, to have left little to be added to the myology of the species.

In the application of the facts detailed to the higher generalizations of the philosophy of organized bodies, it will be found that the unity of the ornithic type is strictly preserved, though under the extremest modifications; the characteristic peculiarities, for example, of the muscles of the spine and those of the wing, are all present, but the proportionate development of these classes of muscles is reversed, the spinal muscles being at their maximum, the alar muscles at their minimum of development. Very interesting peculiarities are likewise manifested by the muscles of the skin, with which I propose to introduce the details of the muscular system of the small Struthious bird of New Zealand.

MUSCLES OF THE SKIN.

No detailed description of the muscles of the skin in Birds has been given either in the systematic works on Comparative Anatomy, or in particular treatises; these muscles appear indeed in general to be too irregularly or too feebly developed to have attracted

[1] Transactions of the Zoological Society, Vol. II. Part 4, p. 257.

much attention: brief notices are recorded of some peculiarly developed cutaneous, or rather cuticular, muscles, as those which spread the plumes of the Peacock, erect the hackles of the Cock, and make each individual feather stand on end in the web-footed birds[1]; the compressors of the subcutaneous air-cells are noticed in the anatomical account of the Gannett (*Sula Bassana*[2]); and a more constant cutaneous muscle, viz. that which supports the crop in Gallinaceous birds, is briefly mentioned and figured by Hunter[3].

In the *Apteryx*, however, the true cutaneous system of muscles presents a more distinct and extensive development than has hitherto been met with in the class of Birds —a condition which is evidently connected with the peculiar thickness of the integument, and probably with the burrowing habits of this species, which thereby possesses the power of shaking off the loose earth from its plumage, while busy in the act of excavating its chamber of retreat and nidification.

Constrictor colli (Pl. XXXI. XXXIV. *a*).—The whole of the neck is surrounded by a thin stratum of muscular fibres, directed for the most part transversely, and extending from an attachment along the median line of the skin at the back of the neck, to a parallel *raphe* on the median line of the opposite side: this muscle is strongest at its commencement or anterior part, where the fibres take their origin in a broad fasciculus from the outer part of the occipital ridge; these run obliquely downwards and forwards on each side of the neck, but are continued uninterruptedly with those arising from the dorsal line of the skin above mentioned; the direction of the fibres insensibly changing from the oblique to the transverse. The outer surface of this muscle is attached to the integument by a thin and dense layer of cellular tissue, devoid of fat; the under surface is more loosely connected with the subjacent parts by a more abundant and finer cellular tissue.

Use.—To brace the cervical integument, raise the neck feathers, and in combination with the following muscle to shake these parts.

Sterno-cervicalis (Pl. XXXI. *b*).—*Origin.* Fleshy, from the posterior incurved angular process of the sternum, from the ensiform prolongation and middle line of the outer and posterior surface of the same bone. *Insertion.* The fibres pass forward, and, diverging in gently curved lines, ascend upon the sides of the broad base of the neck, and are inserted by a thin but strong fascia into the median line of the dorsal integument. This muscle is a line in thickness at its origin, but becomes thinner as it expands; the anterior part is covered by the posterior fibres of the *constrictor colli.*

Use.—To retract the skin of the neck, and brace that portion which covers the base of the neck; when these are the fixed points, it will depress and protract the sternum, and thus aid in inspiration.

Obs.—In its position and the general course of the fibres, this muscle is analogous to

[1] Nitzsch, art. *Dermorhynchi*, Ersch und Grüber's Encyclopedie.

[2] Proceedings of the Zoological Society, 1832, p. 91.

[3] In description of pl. 10, vol. i. of Physiological Catalogue of Hunterian Collection, 4to. 1833–1841.

that which supports and assists in emptying the crop in the common Fowl; but the œsophagus presents no partial dilatation in the *Apteryx*, and the situation of the crop is occupied by a large mass of fat enclosing one or two absorbent glands (Pl. XXXIV. *a'*).

Sterno-maxillaris (Pl. XXXIV. *c*).—This muscle appears at first view to be the anterior continuation of the preceding, but is sufficiently distinct to merit a separate description and name. *Origin.* Fleshy; from the anterior part of the middle line of the sternum. *Insertion.* It passes directly forwards along the under or anterior part of the neck, expanding as it proceeds, and gradually separating into two thin symmetrical fasciculi, which are insensibly lost in the integument covering the throat and the angle of the jaw. It adheres pretty closely to the central surface of the *constrictor colli*, along which it passes to its insertion.

Use.—To retract the fore-part of the skin of the neck, and also the head. Each lateral portion acting alone would incline the head to its own side: the whole muscle in action would bend the neck; but the movements of the head and neck are more adequately and immediately provided for by the appropriate deeper-seated muscles, and the immediate office of the present muscle is obviously connected with the skin. Nevertheless, in so far as this muscle acts upon the head, it produces the same movements as the *sterno-mastoideus* in Mammalia; and it is interesting to observe, that in the long-necked Ruminants (as the Giraffe) the sterno-mastoid muscles arise by a common origin, and the insertion is by an extended fascia into the angles of the jaw: I consider, therefore, that the *sterno-mastoideus* is represented by the *sterno-maxillaris* in the *Apteryx*.

Dermo-transversalis (Pl. XXXIV. fig. 1. *d*).—The skin covering the dorsal aspect of the lower two-thirds of the neck, besides being acted upon by the *constrictor colli*, is braced down by a thin stratum of oblique and somewhat scattered fibres, which take their origins by fasciæ attached to the inferior transverse processes of the sixth to the twelfth cervical vertebræ inclusive; the fibres pass obliquely upwards and backwards, and are inserted by a thin fascia into the median line of the skin, covering the back of the neck.

Platysma myoides (Pl. XXXI. *e*).—The representative of this cutaneous muscle is a thin triangular layer of muscular fibres, taking their origin from the outer side of the ramus of the jaw, and diverging as they descend to spread over the throat, and meeting their fellows at a middle *raphe* of insertion beneath the upper larynx and beginning of the trachea, which they thus serve to compress and support.

Dermo-spinalis (Pl. XXXI. *f*).—*Origin.* By a thin fascia from the ends of the spinous processes of the three anterior dorsal vertebræ. *Ins.* The fibres slightly converge to be attached to the integument covering the scapular region.

Dermo-iliacus (Pl. XXXI. *g*).—*Origin.* Fleshy, from the anterior margin of the ilium. *Ins.* The fibres pass forwards and slightly converge to be inserted into the scapular integument.

Dermo-costalis (Pl. XXXI. *h*).—A muscle resembling the preceding in form. *Origin.* Fleshy, from the costal appendages of the seventh and eighth ribs. *Ins.* The fibres pass forwards and join those of the preceding muscle, to be inserted into the scapular integument.

Obs. The three preceding muscles are broad and thin, but well-defined; they would appear to influence the movements of the rudimentary spur-armed wing through the medium of the integument, as powerfully as do the rudimental representatives of the true muscles of that extremity.

There are also two muscles belonging to the cutaneous series, and inserted directly into the bones of the wing. One of these, the *Dermo-ulnaris* (Pl. XXXI. *i*), is a small, slender, elongated muscle, which takes its origin from the fascia beneath the *dermo-costalis*; its fibres pass backwards, and converge to terminate in a very slender tendon which expands into a fascia, covering the back part of the elbow-joint.

Use.—To extend the elbow-joint and raise the wing.

The *Dermo-humeralis* (Pl. XXXI. *k*) is also a long and narrow strip, deriving its origin from scattered tendinous threads in the subcutaneous cellular tissue of the abdomen: it passes upwards, outwards and forwards, and is inserted fleshy into the proximal part of the humerus, which it serves to depress[1].

Muscles of the Trunk.

A. On the Dorsal Aspect.

The muscles on the dorsal aspect of the vertebral column in Birds have only of late years received any attention from Comparative Anatomists: they have been mentioned rather than described by Tiedemann and Meckel: Carus has given a side-view of the superficial layer of muscles in the Sparrow-hawk; their best description is contained in the second edition of the 'Leçons d'Anatomie Comparée' of Cuvier.

The muscles of the back are in general so feebly developed in birds of flight, that they were affirmed by Cuvier to be wanting altogether in the first edition of the 'Leçons:' and this is almost true as respects their carneous portion, for they are chiefly tendinous in birds of flight. In the Struthious birds, and in the Penguin, in which the dorsal vertebræ are unfettered in their movements by anchylosis, these muscles are more fleshy and conspicuous; but they attain their greatest relative size and distinctness in the *Apteryx*.

From the very small size of the muscles which pass from the spine to the scapula and

[1] In Mammalia the cutaneous muscles form a more continuous stratum than in the *Apteryx* and other birds, and hence have been grouped together under the common term *panniculus carnosus*; they have also, in general, both their origins and insertions in the integument; but in Birds the integument supports so extraordinary an abundance of the epidermic material under the form of feathers, that the muscles destined to its especial motions require a more fixed attachment from which to act. The Rhinoceros, in which the integuments, from the thickness and density of the corium, are in a similar condition as regards the resistance to be overcome by their peculiar muscles, presents an analogous condition of the *panniculus carnosus*, having it divided into several distinct muscles, most of which take their origin from bone or fasciæ attached to bone.

humerus in the *Apteryx*, the true muscles of the back, which correspond to the second layer of the dorsal muscles in Man, become immediately visible on removing the dorsal integuments and fasciæ; they consist of the *sacro-lumbalis, longissimus dorsi*, and *spinalis dorsi*. The first two muscles are blended together at their posterior origins, but soon assume the disposition characteristic of each as they advance forwards.

The *sacro-lumbalis* (Pl. XXXII. XXXIII. *l*) is a strong and fleshy muscle, six lines in breadth, and three or four lines in thickness: it is, as usual, the most external or lateral of the muscles of the back, and extends from the anterior border of the ilium to the penultimate cervical vertebra. *Origin*. By short tendinous and carneous fibres from the outer half of the anterior margin of the ilium, and by a succession of long, strong, and flattened tendons (Pl. XXXIII. fig. 2. *l* 1–*l* 5) from the angles of the fifth and fourth ribs, and from the extremities of the transverse processes of the third, second, and first dorsal vertebræ; also by a shorter tendon (*l* 6) from the transverse process of the last cervical vertebra; these latter origins represent the *musculi accessorii ad sacro-lumbalem*; to bring them into view, the external margin of the *sacro-lumbalis* must be raised, as in Pl. XXXIII. fig. 2. These accessory tendons run obliquely forward, expanding as they proceed, and are lost in the under surface of the muscle.

Insertion. By a fleshy fasciculus with very short tendinous fibres into the angle of the sixth rib, and by a series of corresponding fasciculi, which become progressively longer and more tendinous, into the angles of the fifth, fourth, third and second ribs (Pl. XXXII. *l**), and into the lower transverse processes of the first dorsal and last two cervical vertebræ: the last insertion is fleshy and strong; the four anterior of these insertions are concealed by the upper and outer fleshy portions of the *sacro-lumbalis*, which divides into five elongated fleshy bundles (Pl. XXXII. *l***), inserted successively into the upper transverse processes of the first three dorsal and last two cervical vertebræ. These last insertions seem to represent the continuation of the *sacro-lumbalis* in Man, which is termed the *cervicalis descendens* or *ascendens*.

Longissimus dorsi (Pl. XXXII. XXXIII. *m*).—This muscle is blended posteriorly both with the *sacro-lumbalis* and the *multifidus spinæ*, and anteriorly with the outer portion of the *spinalis dorsi*. It extends as far forward as the thirteenth cervical vertebræ. *Origin*. From the inner or mesial half of the anterior margin of the ilium; from a strong aponeurosis attached to the spines of the eighth, seventh and sixth dorsal vertebræ; and from the transverse processes of the sixth, fifth, fourth and third dorsal vertebræ. *Ins*. The carneous fibres continued from the second origin, or series of origins from the spinous processes, incline slightly outward as they pass forward, and are inserted into the posterior articular processes of the first three dorsal vertebræ, receiving accessory fibres from the *spinalis dorsi*. The fasciculi from the transverse processes incline inwards, and are also inserted into the posterior oblique processes of the vertebræ anterior to them; they receive fibres from the iliac origin, and soon begin to form a series of oblique carneous fasciculi, which become more distinct as they are situated more anteriorly; they are at first implanted in the vertebra next in front of that from which they rise, and then into the vertebra next but one in front (m^*) : the most anterior of these tendons of insertions, to which can be traced any of the fibres of the main body of the *longissimus dorsi* (reflected back in Pl. XXXIII. fig. 1, *m*) is that which is implanted into the thirteenth cervical vertebra (m^{**}) ; it is this fasciculus which is joined by the first or most posterior of the *fasciculi obliqui* of the *longus colli posticus* (*o* 1) which is detached and reflected upwards in fig. 1. Pl. XXXIII.

Obliquus colli (Pl. XXXII. XXXIII. *m* 1—9).—A series of oblique carneous fasciculi, evidently a continuation of, or part of the same system with those in which the *longissimus dorsi* terminates anteriorly, is continued between the upper transverse process of one cervical vertebra to the posterior oblique processes of the next vertebra but one in advance, as far forward as the fourth cervical vertebra. This series of muscles seems to represent the *transversalis colli*[1], which is the anterior continuation of the *longissimus dorsi* in Mammalia, but it differs in being inserted into the oblique, instead of the transverse processes. In the direction of their fibres these fasciculi resemble the *semispinalis colli*, but they are inserted into the oblique processes instead of the spines of the vertebræ. There are no other muscles with which they can be compared in the Mammalia than these two, with neither of which, however, do they precisely correspond; they seem clearly to represent the second series of oblique muscular fasciculi in the trunk of Fishes, but to avoid the expression of an incomplete or false analogy, I shall term them collectively the *fasciculi obliqui*.

The *fasciculi obliqui* which rise from the first two dorsal and five lower cervical vertebræ are joined near their tendinous terminations by corresponding oblique fasciculi (*o* 1—8) of the *longus colli posticus*, and the strong round tendons continued from the points of convergence of these fascicles are inserted successively into the posterior oblique processes of the twelfth to the sixth cervical vertebra inclusive; the two fasciculi next in succession receive no accessory fibres from the *longus colli posticus*; the anterior one (*m* 9) derives an extensive origin from the upper transverse processes of the eighth, seventh, and sixth cervical vertebræ. It must be observed, however, that the whole of each fasciculus is not expended in the strong round tendinous insertion above described; the portion (m^*, fig. 1. Pl. XXXIII.), which arises from the anterior ridge of the transverse process, passes more directly inwards than the rest, and is attached to the tendon which terminates the fasciculus immediately behind; at the middle of the neck these accessory fibres approach to the character of distinct origins. The tendons of insertion, moreover, severally receive accessory fleshy fibres (*n n*, fig. 1. Pl. XXXIII.) from the base of the

[1] It is the '*grand transversaire*' of Cuvier, *loc. cit.* p. 282; but he describes it as passing from the anterior articular process of one vertebra to the posterior articular process of the next in front. Meckel, who calls this muscle '*intertransversalis cervicis*,' follows Cuvier in the description of its attachments, and adds, that it is a continuation of the outer division of the '*extensor communis dorsi*' (*sacro-lumbalis*). In the Apteryx it is plainly a continuation of the inner division or *longissimus dorsi*. See Vergleich, Anatomie, Th. 3. p. 294.

oblique processes of the two vertebræ next behind; and thus they become the medium of muscular forces acting from not less than five distinct points, the power of which is augmented by each tendon being braced down by the oblique converging series of muscles immediately anterior to it. The fasciculus from the eighth cervical vertebra, besides its insertion by the ordinary tendon, sends off externally a small pyramidal bundle of muscular fibres (Pl. XXXII. *n**), which soon terminates in a long and slender tendon which is inserted into the oblique process of the third cervical vertebra. Corresponding portions of muscle (Pl. XXXII. & XXXIII. *n***) are detached from the two anterior fasciculi, which converge and terminate in a common slender tendon inserted into the posterior oblique process of the fourth cervical vertebra; and thus terminates this complex muscle or series of muscles.

Longus colli posticus (Pl. XXXII. & XXXIII. fig. 1. *o* 1—9).—The most internal or mesial of the superficial muscles of the dorsal aspect of the thoracic and cervical regions, called *cervicalis ascendens* by Meckel, and compared in part with the *spinalis dorsi* by Cuvier, cannot be the representative of either of these muscles, since they both (*l*** & *p*) co-exist separately with it in the *Apteryx*. At its posterior part the muscle in question seems to be rather a continuation of the *longissimus dorsi*; its mesial and anterior part offers a strong analogy with the *biventer cervicis*; it appears to me to be evidently the analogue of the first, or mesio-dorsal series of oblique fibres of the muscular system in Fishes, but I shall adopt the name of the *longus colli posticus* applied to it by Cuvier[1]. It commences by long and slender, but strong, subcompressed tendons from the spines of the sixth, fifth and fourth dorsal vertebræ (Pl. XXXIII. *o*): these tendons gradually expand as they proceed forwards and downwards, and send off from their under surface muscular fibres which continue in the same course, and begin to be grouped into distinct fasciculi at the base of the neck: the first of these bundles (*o* 1) joins the fasciculus of the *longissimus dorsi* (*m***), which is inserted into the posterior articular process of the thirteenth cervical vertebra; the succeeding fasciculi derive their origins from a broad and strong aponeurotic sheet attached to the spines of the fourth, third and second dorsal vertebræ: the second to the eighth fasciculi inclusive are compressed, broad and fleshy, and are inserted in the strong round tendons described in the preceding muscle, and attached to the oblique processes of the twelfth to the sixth cervical vertebræ inclusive: the ninth fasciculus (*o* 9), which forms the main anterior continuation of the *longus colli posticus*[2], is larger than the rest, and receives, as it advances, accessory fibres from the spinous processes of the seventh (o^{x}) to the third cervical vertebræ inclusive, and is inserted, partly fleshy, partly by a strong tendon, into the side of the broad spine of the *vertebra dentata*. A slender fasciculus is detached from the mesial and dorsal margin of the *longus colli posticus*, near the base of the neck, which soon terminates in a long round tendon (o^{xx}): this tendon is braced down by short aponeurotic fibres to the spine of the fifth, fourth, third and

[1] Leçons d'Anat. Comp., 2nd edit. vol. i. p. 284.

[2] '*Accessoires du long postérieur du cou*,' Cuvier, *loc. cit.* p. 284.

second cervical vertebræ inclusive, immediately beyond which it again becomes fleshy, and expands to be inserted into the occipital ridge: this portion is the *digastrique* or *biventer capitis* of Cuvier.

Spinalis dorsi (Pl. XXXIII. fig. 1. *p*).—The displacement of the dorsal portion of the preceding muscle and the *longissimus dorsi* brings into view the *spinalis dorsi*, which is a well-developed and distinct muscle in the *Apteryx*. *Origin.* By two long, narrow, flattened tendons (*p*, 1 & 2.) from the spines of the eighth and seventh dorsal vertebræ: these pass obliquely downwards and forwards, expanding as they proceed, and terminate in two fasciculi of muscular fibres: the posterior bundle passes forwards beneath the anterior one, and inclining inwards and upwards, divides into two portions, inserted by long tendons into the spines of the second and first dorsal vertebræ (*p* 1*) ; it then sends a few fibres forwards to join the outer and anterior fasciculus, which is partly inserted by a slender tendon into the spine of the last cervical vertebra: the rest of the fibres of the second fasciculus join the portion of the *longissimus dorsi* (*m*) which is implanted into the posterior oblique process of the last cervical vertebra. The three inserted tendons of the *spinalis dorsi* are also the medium of attachment of fibres continued from the *multifidus spinæ*, beneath them.

Multifidus spinæ (Pl. XXXIII. fig. 1. *q*).—The series of muscles so called arises by fleshy fibres from the transverse processes of the five last dorsal vertebræ, which pass upwards, forwards and inwards, to be inserted by four flat tendons into the spines of the seventh to the third dorsal vertebræ inclusive, and by the tendons of the *spinalis dorsi* into the two anterior dorsal spines.

Obliquo-spinales (Pl. XXXIII. fig. 3. *r*).—The removal of the *multifidus spinæ* brings into view a series of long, narrow, flat tendons, coming off from the spines of all the dorsal vertebræ, and slightly expanding as they proceed forwards and obliquely downwards and outwards ; they become fleshy half-way from their origin, and are inserted into the posterior oblique and transverse processes of the six anterior dorsal vertebræ, and into the posterior oblique processes of the three last cervical vertebræ.

Interspinales (Pl. XXXIII. fig. 3. *s*).—The *interspinales* muscles do not exist in the region of the back, unless we regard the preceding oblique fibres as a modified representation of them. The most posterior fasciculus of muscular fibres, which is directly extended between the spinous processes, commences at the interspace of the spines of the two last cervical vertebræ, and the series is continued as far as the *vertebra dentata*.

Interarticulares (Pl. XXXIII. fig. 3. *t*).—The muscles which form the more direct continuation of the *obliquo-spinales* are continued from the posterior oblique or articular processes of one vertebra to the posterior articular process of the next in front.

Obliquo-transversales (Pl. XXXIII. fig. 3. *v*).—A third series of deep-seated intervertebral muscles is situated external to the preceding, and passes obliquely between the upper transverse process and the posterior articular process of the vertebra in front. These fasciculi appear to be a continuation of the *multifidus spinæ* in the neck.

Intertransversales (Pl. XXXIII. fig. 3. *w*).—These are two series of short carneous fasciculi passing the one between the upper, and the other between the lower transverse processes.

Levatores costarum (Pl. XXXIII. fig. 3. *x*).—The first or most anterior of this series of muscles seems to represent the *scalenus medius* (*x**); it arises from both the upper and lower transverse processes of the last cervical vertebra, and expands to be inserted into the first rib, and into the upper and outer part of the second rib. The remaining *levatores* successively diminish in size as they are placed backwards; they come off from the transverse processes of the first six dorsal vertebræ; those from the first and second expand to be inserted into the rib attached to the same transverse process and to the one next behind; the rest have a single insertion: the angle and the part of the rib immediately beneath are the situations of their attachments.

Complexus (Pl. XXXII. XXXIV. fig. 1. *y*).—This strong triangular fleshy muscle arises from the articular and upper transverse processes of the fourth, third and second cervical vertebræ, and gradually expands as it advances forwards to be inserted into the occipital ridge, from the outer side of the insertion of the *biventer cervicis* to the mastoid process.

Recti capitis postici.—These small muscles are concealed by the preceding; they rise successively from the spines of the third, second and first cervical vertebræ, and expand as they advance to be inserted into the occiput.

Trachelo-mastoideus (Pl. XXXIV. fig. 1. *z*).—This strong, subdepressed carneous muscle arises from the upper transverse processes of the fifth, fourth, third and second cervical vertebræ, and is inserted into the side of the base of the occiput.

B. In Front of the Neck.

Longus colli (Pl. XXXIV. fig. 2. & XXXV. *a*).—This large and long muscle, which appears simple when first exposed, as in Pl. XXXIII. fig. 2, is found to consist, when unravelled by further dissection, of a series of closely succeeding long, narrow fasciculi, arising from the hæmapophyses of the sixth dorsal to the first dorsal and from the ten posterior cervical vertebræ (Pl. XXXV. *a a*); and sending narrow tendons (*ib. a**) which increase in length as they are given off more anteriorly, obliquely forwards and outwards, to be inserted into the costal processes of all the cervical vertebræ save the first two: the highest or foremost tendon (*ib. a***) is attached to the tubercle at the under part of the ring of the atlas; but this tendon is also the medium of insertion of five small fasciculi of muscular fibres (Pl. XXXV. fig. 2. *a***) arising from the upper transverse processes of the sixth, fifth, fourth, third and second cervical vertebræ.

The *Rectus capitis anticus major* (Pl. XXXV. *b*) is continued, or arises by as many distinct tendons, from the five superior tendons of insertion of the preceding muscle; these origins soon become fleshy, converge, and coalesce previous to their insertion into the base of the skull.

The *Rectus capitis anticus minor* (Pl. XXXV. *c*) is a strong fleshy compressed triangular muscle arising from the anterior part of the body of the first four cervical vertebræ. *Ins.* Base of occiput.

The *Rectus capitis lateralis* (Pl. XXXII. XXXV. *d*) arises from the upper transverse processes of the sixth to the second cervical vertebra inclusive. *Ins.* Side of the base of the skull.

C. Muscles of the Tail.

Levator caudæ.—Origin. From the posterior and superior extremity of the ischium. *Ins.* Into the spines of the caudal vertebræ.

Adductor caudæ superior.—This muscle is smaller than the preceding, with which it runs parallel; it rises below from the posterior extremity or tuber of the ischium, and is inserted into the transverse processes of the caudal vertebræ.

Adductor caudæ inferior.—Origin. From the tuber ischii, and the ligament connecting this with the posterior extremity of the pubis. *Ins.* Into the transverse processes of the caudal vertebræ.

Depressor caudæ.—Origin. From the under part of the middle line of pelvis. *Ins.* Into the inferior spines of the caudal vertebræ.

D. Muscles of the Abdomen.

Obliquus externus abdominis (Pl. XXXII. XXXV. *e*).—*Origin.* Fleshy, from the second and third ribs, and by a strong aponeurosis from the succeeding ribs near the attachment of the costal processes, and from those processes. *Ins.* The fleshy fibres are continued from this aponeurotic origin to nearly opposite the ends of the vertebral ribs; they run almost transversely, very slightly inclined towards the pubis, to within half an inch of the linea alba, and there terminate, by an almost straight, parallel line, in their aponeurosis of insertion. The fibres of this aponeurosis decussate those of the opposite side, and adhere to the tendinous intersections of the *rectus* beneath. The aponeurosis from the last rib passes to be inserted into a strong ligament extending between the free extremities of the *ossa pubis*, leaving the abdomen behind the last rib, defended only by the *internal oblique* and *transversalis*.

Obliquus internus abdominis (Pl. XXXV. *f*).—*Origin.* From the whole of the anterior and outer surface of the pubis; aponeurotic from the upper part, fleshy for half an inch from the lower or ventral extremity: the carneous fibres run longitudinally, and cannot be distinctly defined from the *intercostales* on their outer border, or from the *rectus abdominis* on their inner or mesial border, which forms the medium of the insertion of the internal oblique.

Rectus abdominis (Pl. XXXV. *g*).—I give this name to the mesial continuation of the preceding muscle, which arises by a strong, flat, triangular tendon (*g*) from the lower or ventral extremity of the pubis and from the inter-pubic ligament: it soon becomes fleshy; the carneous portion is interrupted by three broad, oblique, but distinct aponeurotic intersections (g*), and is finally inserted into the xiphoid and lateral processes of the sternum and the intervening fascia.

Transversalis abdominis.—A layer of loose, dark-coloured cellular tissue divides the internal oblique from the transverse abdominal, except at its origin from the pubis, and for half an inch anterior to that part.

The *transversalis* then proceeds to derive carneous fibres from the inner surface of the vertebral ribs near their lower third; they pass obliquely upwards and forwards, and terminate by a regular, slightly concave line midway between their origins and the extremities of the ribs; a strong aponeurosis passes thence to the linea alba, but becomes thin at the pubic region, where a mass of fat is interposed between it and the peritoneum.

Diaphragm (Pl. XXXVI. & LII. Vol. ii.).—This muscle presents more of its normal mammalian character in this than in any other known bird. It is perforated by vessels only, in consequence of the non-development of the abdominal air-cells. The origin corresponding to that of the lesser muscle in Mammalia is by two strong and distinct, short tendinous pillars (a a), from the sides of the body of the last costal vertebra; they are united by a strong tendon or fascia, forming the anterior boundary of the aortic passage. The tendinous pillars may be traced forward for some way in the central aponeurosis, expanding without crossing; they are then lost in that aponeurosis, which is perforated by the gastric arteries and veins; decussates and divides anteriorly (at b) to give passage to the gullet and the apex of the heart; the aponeurosis expands over the anterior part of the thoracic air-cells, and becomes, at its lateral circumference, the point of attachment of muscular fibres arising from the inner surface of the anterior ribs, and forming apparently a continuation of the *transversalis abdominis.*

Appendico-costales (Pl. XXXII. h).—*Origin.* From the posterior edge and extremity of the costal processes or appendages. *Ins.* They run down to be inserted severally into the rib posterior to that to which the process affording them origin is attached. These processes are supported by strong triangular aponeuroses continued from their anterior and upper margins, severally, to the rib anterior to them.

The muscles of the jaws have already been described in the account of the digestive organs[1]. The following are shown in Pl. XXXII.: α, *temporalis externus*; β, *temporalis internus*; γ, *biventer maxillæ*; the masseter has been removed, but is shown at η, Pl. XXXIV. fig. 1. The internal pterygoid muscle is shown in Pl. XXXV. at ε; the external pterygoid at ζ.

Some of the muscles of the tongue, which are described in the first part of this memoir[2], are delineated in Plate XXXIV. fig. 1.

The strong *orbicularis palpebrarum* has been divided and reflected forwards at δ, Pl. XXXII.; it is shown *in situ* at δ, fig. 1. Pl. XXXIV.

[1] Vol. ii. p. 263.

[2] Ib., p. 264.

Muscles of the Anterior Extremity.

Serratus magnus anticus (Pl. XXXII. XXXIV. *i*).—This muscle consists of three portions; the first and anterior portion (Pl. XXXIV. fig. 2. *i*) arises by a short, strong aponeurosis from the last cervical rib, and is inserted into the lower edge of the anterior two-thirds of the scapula: the second and middle portion arises from the lower end of the second vertebral rib, near the attachment of the costal process, and from the anterior margin of the same rib, and is inserted into the lower edge of the posterior two-thirds of the scapula: the third, posterior and smallest portion (Pl. XXXII. *i*) rises from the costal process of the third rib, and ascends to be inserted into the posterior extremity of the scapula.

This muscle is a direct inspirator: by drawing down the scapula it depresses the sternum through the medium of the strong coracoideum, increases the angle between the vertebral and sternal ribs, and dilates the thoracic air-cells.

Levator scapulæ (Pl. XXXII. XXXIV. *k*).—This seems to be the most anterior portion of the series of muscles which constitute the *serratus magnus*. *Origin.* Two flat fleshy strips from the inferior transverse and costal processes of the last and penultimate cervical vertebræ. *Ins.* Into the inner and upper side of the middle third of the scapula. It depresses as well as draws forwards the scapula, and thus aids the *serratus* in the action of inspiration.

Serratus anticus minor.—*Origin.* From the outer part of the costal process of the sternum. *Ins.* Into the posterior part of the base of the coracoideum.

Trapezius (Pl. XXXIV. *l*).—This flattened oblong quadrilateral muscle arises from the fascia, extending upon the back from the spinous processes of the posterior cervical vertebræ, and is inserted into the conjoined extremities of the scapula and coracoideum.

There is no representative of the *rhomboidei.*

Latissimus dorsi (Pl. XXXIV. *m*).—This muscle consists, as usual in Birds, of two portions, both of which have their origin from a continuation of the fascia, attached to the spinous processes, which gives attachment to the trapezius: the fibres of the smaller and anterior strip converge to their insertion: the fibres of the posterior and broader strip are slightly twisted, the posterior edge being folded inwards as they also converge to join the preceding, and to be inserted with it into the posterior and inner side of the proximal extremity of the humerus.

Deltoides (Pl. XXXI. XXXIV. *n*).—This is a single long and narrow triangular muscle, of which the base is attached to the conjoined extremities of the scapula and coracoid, and to the capsule of the shoulder-joint; the apical insertion is into the upper and outer third of the humerus, which this muscle directly raises.

Infraspinatus (Pl. XXXII. *o'*).—A muscle which may be compared either to the *infraspinatus* or *teres major* comes off from the lower margin of the anterior two-thirds of the scapula, passes behind the shoulder-joint, where it is closely attached to the capsule, and is inserted into the inner and posterior part of the proximal end of the humerus.

Musculi pectorales.—The pectoral muscles, which present their feeblest condition and lowest development in the *Apteryx*, are nevertheless similar in number and arrangement to those which in some birds of flight are known to outweigh all the other muscles of the body.

The *pectoralis major* (Pl. XXXI. XXXII. XXXIV. XXXV. *p*) is represented by two very thin triangular layers of muscular fibres, the anterior of which is three lines broad at its base, and is attached to the sternum immediately exterior to the perforation of that bone: the second, posterior, and somewhat narrower portion, rises immediately behind the preceding, from the osseous bridge separating the perforation from the notch; the two portions converge as they extend upwards and outwards to unite and be inserted into the anterior and internal surface of the proximal third of the humerus.

The *pectoralis medius seu secundus* (Pl. XXXII. XXXV. *q*) is a similar, thin, feeble, but broader triangular layer of carneous fibres, which arise anterior to the preceding, just below the coracoid socket of the sternum, and converge as they wind over the shoulder-joint to be inserted into the upper surface of the proximal extremity of the humerus, of which they thus become an elevator.

The *pectoralis minor seu tertius* (Pl. XXXII. XXXV. *r*) arises above and between the origins of the *pectoralis secundus* and the anterior strip of the *pectoralis major*, also partly from the coracoid process; its fibres converge to be inserted into the proximal end of the humerus, above and behind the *pectoralis major*.

Coraco-brachialis (Pl. XXXV. *s*).—This is represented by two small strips of muscular fibres which rise from the posterior part of the coracoideum, and are inserted, one directly below the other, into the proximal third of the humerus.

Obs.—The close adherence to the ornithic type of the muscular system of the anterior extremity in the *Apteryx* is more especially remarkable as regards the position and course of the *pectoralis medius*, since the physiological conditions of the circumstances attending that muscle are wanting in the *Apteryx*.

Here we have a true bird, exhibiting a remarkable modification of the whole ornithic structure, in reference to exclusively terrestrial life and nocturnal habits; and we learn, from this adherence to a typical organization, in a very rare exception, that the teleological conclusions respecting that typical construction, as it is manifested in the general rule, are in no ways affected by such an exception; because the modification of one part necessarily affects that of many others, perhaps of the whole body. If, for example, the fixation and structure of the lungs require a broad sternum and concomitant modifications of the coracoid and scapula for the mechanical part of the respiratory process, then it may be more convenient for the levator of the humerus to rise below that bone from the sternum, and act in the due direction by a modification of its course; although the locomotion of the bird may in no way be facilitated by the aggregation of muscular substance beneath the centre of gravity, nor the size of the levator be such as to render its particular position a matter of any consequence in regard to that centre.

A minute flexor (Pl. XXXIV. fig. 2. *t*), wanting the attachment to the scapula which exists in birds of flight, and arising solely from the humerus, glides along the front of that bone, chiefly as a delicate tendon to be attached to the inner part of the head of the ulna.

A single extensor (Pl. XXXIV. fig. 1. *v*), almost equally tendinous and delicate, arises from the scapula, and represents the 'long extensor' of Vicq. d'Azyr: it is inserted into the rudimental olecranon.

There is a tendinous trace of a flexor (*w*) and extensor (*x*) of the minute monodactyle manus: but the motions of the rudimental wing and its terminal hook would seem to be produced as much by the cutaneous muscles which converge to be inserted into the integument connected with it, as by the feeble representatives of the true wing-muscles above described.

Muscles of the Posterior Extremity.

The most superficial of the muscles on the outer side of the leg is that very broad one which combines the functions of the *tensor vaginæ* and *rectus femoris*, but which, in the opinion of both Cuvier[1] and Meckel[2], is the homologue of the *tensor vaginæ* and *glutæus maximus (seu externus)*; since however it is exclusively inserted into the leg, I shall describe it with the other muscles moving that segment of the posterior extremity. The removal of this muscle, of the *sartorius*, and the *biceps cruris*, is requisite to bring into view the true *glutæi*.

Glutæus externus (Pl. XXXII. A).—The external *glutæus* (*glutæus medius* of Meckel) is smaller, as in most Mammalia, than the middle *glutæus*, but is relatively larger in the *Apteryx* than in birds of flight, in which it is described as the *pyriformis* by Cuvier[3]. This muscle, however, besides its origin from the outside of the pelvis, overlaps part of the *glutæus medius*, and has its insertion into the femur at some distance below the great trochanter, all of which are marked characteristics of the *glutæus magnus*. *Origin.* It takes its origin from the superior margin of the os innominatum, extends along an inch and a quarter of that margin, directly above the hip-joint, and is chiefly attached by distinct short tendinous threads, which run down upon the external surface of the muscle: it rises also by carneous fibres from the external surface of the os innominatum for three lines below the superior margin. *Insertion.* The fibres converge and pass into a tendinous sheet, beginning on the external surface of the muscle half-way down its course, which ends in a broad, flat, strong tendon, inserted into a rising on the outer side of the femur nearly an inch below the great trochanter. It abducts and raises the femur.

Glutæus medius (Pl. XXXII. B).—*Origin.* This is the large, triangular, strong and thick muscle, which has an origin of three inches' extent from the rounded anterior and superior margin of the ilium, and from the contiguous outer surface of the bone for an extent varying from an inch to eight lines. *Ins.* Its fibres converge to a strong, short, broad and flat tendon, implanted in the external depression of the great trochanter, having a bursa mucosa interposed between the tendon and the bony elevation anterior to the depression.

[1] Leçons d'Anat. Comp. ed. 1836, tom. i. p. 502.
[2] Vergleich. Anat. 1828, Th. iii. p. 361.
[3] *Loc. cit.* p. 503; it is here called 'pyramidal.'

Glutæus minimus (Pl. XXXII. c).—*Origin.* It rises below and internal to the preceding muscle from the anterior and inferior extremity, and from one inch and three-fourths of the inferior and outer margin of the ilium, and contiguous external surface, as far as the origin of the *glutæus medius*; also by some fleshy fibres from the outside of the last rib. *Ins.* These fibres slightly converge as they pass backwards to terminate in a broad flat tendon which bends over the outer surface of the femur, to be inserted into the elevation anterior to the attachment of the *glutæus magnus.*

A muscle (Pl. XXXII. D.) which may be regarded either as a distinct accessory to, or a strip of the preceding one, arises immediately behind it from half an inch of the outer and inferior part of the ilium; its fibres run nearly parallel with those of the *glutæus minimus*, and terminate in a thin flat tendon, which similarly bends round the outer part of the femur, to be inserted into the outer and under part of the trochanter immediately below the tendon of the *glutæus medius.* This muscle and the preceding portion, or *glutæus minimus*, are described by Prof. Mayer[1] under the names of *Glutæus quartus* and *Glutæus quintus*, in the Cassowary; one of them is absent in most birds.

Use.—All the preceding muscles combine to draw the femur forwards, and to abduct and rotate it inwards.

Iliacus internus.—This is a somewhat short thick muscle, of a parallelogrammic form, fleshy throughout; rising from the tuberosity of the innominatum in front of the acetabulum immediately below the *glutæus minimus*, and inserted at a point corresponding to the inner trochanter, into the inner side of the femur near the head of that bone, which it thus adducts and rotates outwards. This muscle is present both in the Ostrich and Bustard, but Meckel[2] says it is wanting in the Cassowary.

Pyramidalis.—The same kind of modification which affects the *iliacus internus*, viz. the displacement of its origin from the inner surface of the ilium to a situation nearly external, affects this muscle, which, from its insertion and triangular form, I regard as the analogue of the *pyramidalis.* It arises fleshy from the outer surface of the ischium for the extent of an inch, and converges to a broad flat tendon which is inserted into the *trochanter femoris* opposite, but close to the tendon of the *glutæus minimus*, which it opposes, abducting and rotating the femur outwards.

Adductor brevis femoris (Pl. XXXII. E).—A small, long and slender muscle arises from the innominatum immediately behind the acetabulum, passes over the back part of the great trochanter, becomes partially tendinous, and is inserted into the back part of the femur in common with the following muscle.

Adductor longus (Pl. XXXII. XXXV. F).—A long, broad and thin muscle, separated from the preceding by the ischiadic nerve and artery. The origin of this muscle extends one inch and a quarter from near the upper margin of the innominatum which is behind the acetabulum; it is joined by the preceding strip, and is inserted into the whole of the lower two-thirds of the back part of the femur.

[1] Analekten fur Vergleich. Anatomie: 4to. 1839, p. 12.

[2] Arch. fur Physiol. xiii. 261.

Adductor magnus (Pl. XXXV. G).—This broad and flat muscle has an extensive origin (two inches) from the outer edge of the ischium and the obturator fascia; its fibres slightly diverge as they pass downwards to be inserted into the back part of the lower half of the femur, and into the upper and back part of the tibia.

Obturator internus.—This arises from the inner side of the opposite margins of the pubis and ischium, where they form the posterior boundary of the *obturator foramen*, and from the corresponding part of the *obturator fascia*; the fleshy fibres converge in a slightly penniform manner to the strong round tendon which glides through the notch, separated from the rest of the foramen by a short, strong, transverse, unossified ligament, and is inserted into the posterior part of the base of the trochanter. In its length and size this muscle resembles the corresponding one in the Ostrich and other Struthious birds.

Gemellus.—This is represented by a single small fleshy strip arising from the margin of the *obturator foramen*, close to the emergence of the tendon of the *obturator internus*, with which it is joined, and co-inserted into the femur.

Quadratus.—I consider a broad fleshy muscle which arises from the pubis, below the *obturator foramen*, and which increases in breadth to be inserted into the femur internal and posterior to the obturator tendon, to be the true analogue of the *quadratus femoris*.

Tensor vaginæ and *Rectus femoris* (Pl. XXXI. H).—The largest and most remarkable of the muscles which act upon the bones of the leg is that already alluded to as the most superficial of those on the outer side of the thigh. It has a broad, thin, triangular form, and arises from the spines of the sacrum by a strong but short aponeurosis which soon becomes fleshy; the carneous fibres converge as they descend[1], and pass into a thin aponeurosis at the lower third of the thigh: this is closely attached to the muscles beneath (*vastus externus* and *cruræus*), then spreads over the outer and anterior part of the knee-joint, is inserted into the patella, and into the anterior process of the head of the tibia.

Owing to the great antero-posterior extent of the origin of this muscle, its anterior fibres are calculated to act as a flexor, its posterior ones as an extensor of the femur: all together combine to abduct the thigh and extend the leg, unless when this is in a state of extreme flexion, when a few of the posterior fibres glide behind the centre of motion of the knee-joint.

Sartorius (Pl. XXXI. XXXV. I).—The origin of this muscle is characterized by an unusual extension, like that of the preceding, with which it is posteriorly continuous: it comes off aponeurotic, from the anterior and superior margin or labrum of the ilium; the fibres soon become fleshy, and the muscle diminishes in breadth and increases in thickness as it descends: it is inserted by short and strong tendinous filaments obliquely

[1] They are not divided into a superficial and deep layer, as in the Ostrich, but form a simple stratum, as in the Cassowary. Meckel regards the rectus as entirely wanting in the Cassowary, supposing, with Cuvier, the present muscle to be the analogue of the *glutæus maximus* and *tensor vaginæ* united. He says that Professor Nitzsch observed a like absence of the *rectus femoris* in the Emeu. Cuvier calls that muscle *rectus anticus femoris*, which is described in this monograph as the '*pectineus*.'

into the anterior part of the tendon of the broad rectus, and into the anterior and inner part of the head of the tibia. Its insertion is partly covered by the internal head of the *gastrocnemius*.

It bends and adducts the thigh, and extends the leg.

The homologue of the *Biceps flexor cruris* (Pl. XXXI. XXXII. K) is a unicipital muscle, corresponding with the *rectus extensor* in the characteristic modification of its extended origin, in relation to the great antero-posterior development of the pelvic bones: it is exposed by the removal of the *rectus*. *Orig.* By a broad and thin aponeurotic tendon, which at first is confluent with that of the *rectus* but soon becomes distinct, from the posterior prolongation of the ilium: there is no second head from the femur. *Ins.* The fleshy fibres converge as they descend along the back and outer part of the thigh, and finally terminate in a strong round tendon, which glides through a loop (x) formed, as in the common Fowl, Ostrich, &c., by a ligament extended from the back of the outer condyle of the femur to the head of the tibia, and is inserted into the process on the outside of the fibula one inch from its proximal extremity. By means of the loop the weight of the hinder parts of the body is partially transferred, when the leg is bent, to the distal end of the femur; and the biceps is enabled, by the same beautiful and simple mechanism, to effect a more rapid and extensive inflection of the leg than it otherwise could have produced by the simple contraction of its fibres.

Semimembranosus (Pl. XXXII. XXXV. L).—*Origin.* From the side of the coccygeal vertebræ, and from the posterior end of the ischium; it crosses the superficial or internal side of the *semitendinosus*. *Ins.* Into the fascia covering the *gastrocnemius* and the inside of the tibia: through the medium of the fascia it acts upon the tendon (R*) of the internal *gastrocnemius*.

Semitendinosus (Pl. XXXII. XXXV. M).—This muscle arises from the posterior and outer part of the *sacrum* and the aponeurosis connecting it with the *ischium*: it is a flattened triangular muscle, which receives the square *accessorius* muscle (N) from the lower and posterior part of the femur. It gradually diminishes as it descends, and having passed the knee-joint, sends off at right angles a broad and square sheet of aponeurosis, which glides between the two origins of the *gastrocnemius internus*, and is inserted into the lower part of the angular ridge continued from the inside of the head of the tibia. The terminal tendon, continued from the apex of the muscle, then runs along the outer or fibular margin of the internal head of the *gastrocnemius*, and becomes confluent with the tendon of that muscle at R* Pl. XXXV.

Cruræus (Pl. XXXII. XXXV. O).—This is a simple but strong muscle: it commences at the upper and anterior part of the thigh by two extremities, of which the outer and upper one, representing the *vastus externus*, has its origin extended to the base of the trochanter; the inner and inferior comes off from the inner side of the femur, beneath the insertion of the *glutæus magnus*; the two portions blend into one muscle much earlier than in the Ostrich. *Ins.* By the ligamentum patellæ into the fore-part of the head of the tibia.

Gracilis (Pl. XXXV. P).—On the inner side of the *cruræus*, but more superficially, lies a narrow, compressed, long muscle, which rises by two heads, one from the anterior and upper part of the femur, the other from the os pubis; both soon become blended together and transmit a broad thin tendon to be inserted into the lower and lateral part of the patella with the *cruræus*.

Vastus internus (Pl. XXXV. Q).—Two other muscles succeed the preceding, and rise beneath it from the inner and anterior part of the femur; they have a similar insertion, and obviously represent the *vastus internus*. The fibres converge to a middle aponeurosis, which increases to a strong short tendon, inserted into the upper and anterior projection of the tibia.

Popliteus.—This small muscle is brought into view when the superficial muscles of the leg which are inserted into the foot are removed. Its carneous fibres extend from the fibula inwards and downwards to the tibia. It is of relatively smaller extent than in the Cassowary.

Gastrocnemius.—This complex and powerful muscle consists, as in other birds, of several distinct portions, the chief of which correspond with the external and internal origins of the same muscle in the Mammalia. The *gastrocnemius externus* (Pl. XXXI. XXXII. R) arises by a strong, narrow, rather flattened tendon (R*) from the ridge above the external condyle of the femur, which, about an inch below its origin, becomes firmly attached to the strong ligamentous loop attached by one end to the femur above the preceding tendon, and by the other to the outer ridge of the fibula. This trochlear loop, which is displayed by reflecting down the tendon of the *gastrocnemius* in Pl. XXXII., is lined by synovial membrane, and supports the tendon of the *biceps cruris*, which glides through it. The carneous fibres of the external *gastrocnemius* come off from the outer side of the tendon, and from the fascia covering the outer surface of the muscles of the leg: they are continued in a somewhat penniform arrangement two-thirds down the leg, upon the inner surface of the muscle, where they end in a strong subcompressed tendon. This joins its fellow-tendon, from the internal *gastrocnemius*, behind the ankle-joint, and both expand into a thick, strong ligamentous aponeurosis (Pl. XXXII. fig. 2. R), which extends over three-fourths of the posterior part of the tarso-metatarsal bone. The lateral margins of this fascia are bent down under the flexor tendons behind the joint, and become continuous with a strong ligamentous layer gliding upon the posterior surface of the distal condyles of the tibia, and attached to the tendons of the *peroneus* and *tibialis anticus*: the conjunction of the thickened tendons of the *gastrocnemii* with this deeper-seated layer of ligamento-tendinous substance constitutes a trochlear sheath (Pl. XXXV. R***) lined by synovial membrane, through which the flexor tendons of the toes glide. The synovial membrane of the ankle-joint is continued upwards half an inch above the articular surface of the bone, between it and the fibro-cartilaginous pulley. Below the joint the margins are inserted into the lateral ridges of the tarso-metatarsal bone, becoming gradually thinner as they descend, and ending below in a thin semilunar edge directed downwards.

The *gastrocnemius internus* (Pl. XXXV. R) has two powerful heads, one from the femur, the other from the tibia; the first (R)[1] arises fleshy from the internal condyle of the femur, expands as it descends, and receives additional fibres from the lower edge of the *accessorius semitendinosi.* About one-fifth down the tibia this muscular origin in the right leg terminated in a flattened tendon (R*), which became attached to the inner side of the tibial portion of the *gastrocnemius internus* (R**). In the left leg the tendon soon divided; one portion passed to the soleus, the other went to join the tibial portion of the *gastrocnemius internus.* The second head, which is separated from the preceding by the insertion of the *semitendinosus*, arises partly from the internal and anterior part of the strong fascia of the knee-joint by short tendinous fibres, which almost immediately become fleshy, and partly from a well-defined triangular surface (R**) on the inner and anterior aspect of the head of the tibia: the fleshy fibres converge, receive the tendinous slip from the femoral portion, and end on the inner side of the muscle in a strong flattened tendon, about two-thirds down the leg: this joins the tendon of the *gastrocnemius externus* (R *e*), and is inserted as described above.

Soleus[2] (Pl. XXXV. s).—This is a slender flattened muscle arising from the posterior part of the head of the tibia, the tendon of which joins that of the *gastrocnemius internus*, behind the tarsal joint.

The *Flexor perforans digitorum* (Pl. XXXI. XXXII. XXXV. 1) lies immediately anterior to the external *gastrocnemius*; it arises fleshy from the outer condyle of the femur, below the tendinous origin of that muscle, and terminates in a slender flat tendon half-way down the leg. Its tendon (1) glides behind the tarsal joint through the sheath of the *gastrocnemius*, expands beneath the metatarsus and bifurcates, sending its smallest division to the inner toe, and its larger one to blend with the tendon of the *peroneus medius* (12).

Flexor perforatus of the outer toe (Pl. XXXI. XXXII. XXXV. 2).—This arises by very short tendons from the proximal end of the fibula, and from the ligament forming the bicipital pulley; it continues to derive a thin stratum of fleshy fibres from the fascia covering the anterior surface of the muscles of the leg: the fleshy fibres terminate half-way down the leg in a flattened tendon, which, after entering the gastrocnemial sheath, pierces the tendon of the first *perforatus* of the middle toe, then runs forward to the outer toe, expands into a thick ligamentous substance beneath the proximal phalanx, and sends off two tendinous attachments on each side, one to the proximal, the other to the second phalanx, and is continued to be finally inserted into both sides of the third phalanx.

Flexor perforatus digitorum (Pl. XXXII. XXXV. 3, 4, 5, 6) is the strongest of the three; it arises fleshy from the posterior part of the distal extremity of the femur, above the external condyle (Pl. XXXII. 4), and also by a distinct flattened tendon (6), one inch in

[1] This is described as the *soleus* in the Cassowary, by Prof. Mayer, *loc. cit.* p. 15, but the origin of this muscle is not extended in other animals above the knee-joint.

[2] This is described as the *plantaris* in the Cassowary, by Prof. Mayer, *loc. cit.* p. 14, but the normal origin of that muscle should be sought for above the knee-joint.

length, from the proximal end of the tibia: this tendon moreover receives the long slender tendon sent off obliquely across the front of the knee-joint from the *pectineus* (T), by which its origin is extended to the pelvis. This accessory tendon perforates the inner fleshy surface of the muscle, and is finally lost about half-way down the carneous part. Before the *flexor perforatus* is joined by the tendon of the *pectineus*, it subdivides posteriorly into four muscular fasciculi. The anterior division receives principally the above tendon, and this division of the muscle becomes wholly tendinous two-thirds down the leg; its tendon (3) passes through the posterior part of the pulley of the *gastrocnemius*, and expands as it passes along the metatarsus: a thick ligamentous substance is developed in it opposite the joint of the proximal phalanx of the second toe, into the sides of which it is inserted, dividing for that purpose, and giving passage to the two other flexor tendons of that toe. The second portion of the present muscle terminates in a tendon (4) situated behind the preceding, which passes through a distinct sheath behind the tarsal joint, expands into a sesamoid fibro-cartilage beneath the corresponding expansion of the previous tendon, which it perforates, and then becomes itself the perforated tendon of the second phalanx of the second toe, in the sides of which it is inserted. The third portion of this muscle ends in a somewhat smaller tendon (5) than the preceding, which forms the second *perforatus flexor* of the third or middle toe. The fourth and most posterior portion soon becomes a distinct muscle; its fleshy fibres cease on the inner side, one-fourth down the leg, but on the outside they are continued three-fourths down the leg; its tendon (6) passes through the gastrocnemial pulley behind the ankle-joint, and divides to form a sheath for the *flexor perforatus* of the fourth toe; it is then joined by the tendon of the *peroneus* (7), which passes through a pulley across the external malleolus, and finally becomes the perforated tendon of the first phalanx of the middle or third toe.

Pectineus (Pl. XXXII. XXXV. T), (*Rectus anticus femoris* of Cuvier[1] and Meckel[2]).—This is a long, thin, narrow strip of muscle arising from the spine of the pubis, anterior to the acetabulum, and passing straight down the inner side of the thigh; it degenerates into a small round tendon near the knee, which tendon traverses a pulley, formed by an oblique perforation in the strong rotular tendon of the extensors of the leg, and thus passing across the knee-joint to the outer side of the leg, finally expands, and is lost in the *flexor perforatus digitorum* last described. It is this muscle which causes the toes to be bent when the knee is bent.

Peroneus longus (Pl. XXXII. XXXV. 7).—*Origin.* Tendinous from the head of the tibia, and by carneous fibres from the upper half of the anterior margin of the tibia; these fibres pass obliquely to a marginal tendon, which becomes stronger and of a rounded form where it leaves the muscle. The tendon gives off a broad, thin, aponeurotic sheath to be inserted into the capsule of the tarsal joint; it is then continued through a synovial pulley on the side of the outer malleolus, and is finally inserted or continued into the perforated tendon of the middle toe (6).

[1] Leçons d'Anat. Comp. ed. 1836, p. 523.
[2] Vergleich. Anat., Th. iii. p. 365.

Tibialis anticus (Pl. XXXII. XXXV. 8).—This muscle is overlapped and concealed by the peroneus; it arises partly in common with that muscle, and partly by separate short tendinous threads from the outer part of the head of the tibia; it gradually becomes narrower, and finally tendinous two-thirds of the way down the leg; its strong tendon glides through the oblique pulley[1] in front of the distal end of the tibia, expands as it passes over the ankle-joint, and is inserted into the anterior part of the proximal end of the tarso-metatarsal bone, sending off a small tendinous slip to the aponeurosis covering the extensor tendons of the toes, and a strong tendon (8′) which joins the fibular side of the tendon of the following muscle.

Extensor longus digitorum (Pl. XXXV. 9).—This lies between the *tibialis anticus* and the front and outer facet of the tibia, from which it derives an extensive origin; its tendon commences half-way down the leg, runs along the anterior part of the bone, first under the broad ligamentous band representing the anterior part of the annular ligament, then through a ligamentous pulley, and inclines to the inner or tibial side of the anterior surface of the metatarsal bone, where it expands and divides into three tendons. Of these the innermost is given off first, and subdivides into two tendons, one of which goes to be inserted into the base of the last phalanx of the second toe; the other portion is principally inserted into the middle toe, but also sends off a small tendon to the inner side of the proximal phalanx of the second toe. The second tendon is inserted by distinct portions into the second, third and last phalanges of the middle toe. The third tendon supplies the outer toe.

Extensor brevis digitorum (Pl. XXXV. 10).—A small extensor muscle arises from the insertion of the *tibialis anticus*, and sends its tendon to the outer side of that of the great *extensor digitorum*.

Extensor pollicis brevis (Pl. XXXV. 11).—An extensor of the small innermost toe arises from the upper and inner side of the tarso-metatarsal bone.

Peroneus medius, Cuv., *Accessorius flexoris digitorum*, Vicq. d'Azyr (Pl. XXXII. XXXV. 12).—This strong penniform muscle arises fleshy from nearly the whole of the outer surface of the fibula, also from the posterior part of the tibia and the interosseous space; the tendon of the biceps perforates its upper part in passing to its insertion. It ends in a strong flat tendon at the lower third of the leg, which tendon runs through a particular sheath at the back part of the tarsal pulley, becomes thickened and expanded as it advances forwards beneath the tarsus, joins the tendon of the *flexor perforatus* (1), and forms with it the expansion which finally divides into three strong perforating tendons, which bend the last joints of the three long toes.

In the outer, or fourth toe, both the *perforans* and *perforatus* tendons are confined by a double annular ligament; the exterior one being continued from the adjoining toe, the inner and stronger one from the sides of the proximal phalanx of the outer toe.

[1] This is ossified in the Bustard and most true *Grallæ*.

The second and third toes have two perforated tendons; one inserted into the sides of the first, and the other into the sides of the second phalanx.

On a review of the details of the Muscular System above recorded, it will be seen that the analogies of the muscles on the dorsal aspect of the spine with those of Man and the Mammalia, are, in consequence of their unusually strong and distinct development in the Apteryx, more clearly traceable than their condition in other birds perhaps admits of. The same character of the muscles of the hind-extremity has led, as I believe, to a more accurate determination of them than had been adopted by former Comparative Anatomists, among whom the honoured names of Cuvier and Meckel call for a more detailed statement of the grounds on which I have ventured to dissent from views, so sanctioned, than has been given in the descriptive part of the present monograph.

The chief modification of the skeleton of the hind limb of Birds, in respect of size and proportion, is manifested in its central segment; the ossa innominata being anomalously expanded in order to include, as it were, in their grasp the whole of the very long sacrum required for the support of the horizontal trunk upon a single pair of extremities. The principal modification of the muscles of the leg attached to the ossa innominata might be expected, therefore, to be found in their origins. In the attachment of the fibres of a superficial muscle to the aponeurosis, continued from the outer part of the thigh, over the knee-joint, to the head of the tibia, we recognize the corresponding insertion of the *tensor vaginæ femoris* of Man and Mammalia; and no Comparative Anatomist appears to have thought the anomalous development and extensive origin of this muscle, in Birds, to be any objection to the homology indicated by its insertion, which is the attachment that mainly governs the function of a muscle. Now besides the attachment to the femoral fascia, we find this broad superficial muscle, and especially its middle and posterior fibres, terminating in a strong tendon, implanted into the upper part of the patella, and receiving fibres from the *cruræus* and *vasti* muscles which it immediately covers, and with which it concurs in constituting a *quadriceps extensor* of the leg. Here, therefore, we perceive the normal insertion, the normal function, and the true relative position of the *rectus femoris*: and shall we reject these concordances on account of the modification of unusually extended origin? By parity of reason, we ought to reject the admitted homology of the *tensor vaginæ*; and not only of this, but also of the *sartorius* and *biceps cruris*, both of which have undergone equal or greater modifications of origin in the class of Birds. It is true that the *glutæus maximus* is the most superficial of the outer muscles of the thigh in Man and Mammalia, and that it has the most extensive origin and largest size in Man; but superior size and extensive origin are far from being the characters of the *glutæus externus* in the lower Mammalia, in which it much more frequently manifests the proportions, as compared with the *glutæus medius*, which the muscle to which I have assigned the name of *glutæus externus* in the Apteryx, presents. But if the *rectus femoris* has undergone, as I believe, a similar modification of origin to that which characterizes the *tensor vaginæ*, *sartorius* and *biceps*, it would, by its extension along the spines of the sacrum, cover and mask the true *glutæus externus*, which arises from part of the outer surface as well as from the crista of the ilium; and by the same modification of the *rectus*, that connection between the *tensor* and *glutæus*, which is present in some quadrupeds, would be severed; while the more common close proximity of origin of the *rectus* and *tensor* is maintained. Already, in the Kangaroo, we find the origin of the *rectus femoris* extending from above the acetabulum higher up than usual upon the iliac bone. If, therefore, the great superficial muscle in question does not include the *rectus femoris* with the *tensor vaginæ*, then, with the evidence of the true *glutæus externus* in the muscle A Pl. XXXII. of the Apteryx, I should feel bound to regard it as an enormous development of the *tensor vaginæ* alone.

Meckel assigns as his reason for regarding the muscle which I have called *glutæus externus* to be the *glutæus medius*, that its origin and relations to the other levators and abductors of the thigh are absolutely the same as the *glutæus medius* in Mammals[1]. It is, he says, covered by the *glutæus maximus*, meaning H Pl. XXXI., or the great 'pyramidal' of Vicq. d'Azyr; but we are not bound to admit, in the absence of proof, that the great pyramidal of Vicq. d'Azyr is the *glutæus maximus*; and until this be satisfactorily established the argument is of no weight. Reasons have been already given for regarding the *glutæus externus* of Meckel as the combined *tensor vaginæ* and *rectus femoris*. The true *glutæus externus* is hidden in most birds, by the extraordinary extension of the origin of the *rectus extensor cruris* on one side, and of the *biceps flexor cruris* on the other; but, though covered, the *glutæus externus* is the outermost of the three *glutæi* which are recognizable in the Apteryx. The more posterior position of its origin and its lower insertion, together with its inferiority of size as compared with the muscle which I have called *glutæus medius*, are characters which the *glutæus externus* of the Apteryx has in common with that muscle in most Mammalia, and especially in the genera *Macropus* and *Dipus*, which most resemble Struthious birds in the proportions and functions of their locomotive extremities.

To attempt to conceive the muscle Pl. XXXII. A. to be the homologue of the *pyriformis* involves so anomalous an inversion of position in respect of the pelvis, of relations to other muscles inserted into the proximal part of the femur, and of both origin and insertion, as can only be accounted for by the difficulty in which Cuvier, having recognized the true *glutæus medius*, found himself in respect to the homologue of the *glutæus externus*, having applied the name of that muscle to the expanded *tensor* and *rectus*, by which it is covered.

[1] *Loc. cit.* p. 352.

The remarkable concordance of the muscles of the rudimental wing in the Apteryx with those in ordinary birds of flight, has been already pointed out. Nor is the correspondence less remarkable in the muscles of the leg and foot, especially as manifested in the condition of the 'perching muscle' (*pectineus*), in which it could hardly have been anticipated. The strong flexors and extensors of the leg and toes are strictly adapted to the exigencies of a bird which obtains probably most of its nourishment from the earth by means of feet resembling those of the *Gallinacea*, and which owes its safety to the speed with which it runs by means of legs which have almost the proportions of those of the Struthious tribe; and which, finally, is reported to seek concealment and to incubate in subterraneous burrows.

Female Organs of the Apteryx australis.

The trunk of a specimen of this species, transmitted to me from New Zealand by the lamented botanist Mr. Cunningham, having proved to be that of a female, enables me to add to this anatomical monograph the description of the organs of generation in that sex. These consisted of two ovaria and one oviduct. The right ovarium (Pl. XXXVI. *a*), was, as usual in Birds, in an atrophied state, and situated in front of the corresponding suprarenal body, attached to that body and the adjoining trunk of the *vena cava*. It was a small, flattened, minutely granular body, measuring eight lines by five lines, and about one line in thickness.

The left ovarium (Pl. XXXVI. *b*) was in a state of full development, of the usual racemose structure, consisting principally of one enormous calyx (*b*), ripe for dehiscence, containing the vitellus of an ovum, which measured three inches in length by two inches in breadth, indicating an unusually large egg for the size of the bird. All the other calyces were comparatively small, and the greater number of minute size.

The oviduct commenced by the usual simple unfringed or entire slit-shaped aperture (*c*), two inches in its long diameter: the tube soon contracted to a diameter of half an inch, with longitudinally plicated walls, indicating its dilatability: it then expanded to an inch diameter, and after slightly contracting, suddenly enlarged, to form the uterine or shell-secreting part (*d*), which was nearly one inch and a half in diameter; here the muscular tunic is thicker, and the lining membrane presents a peculiar character, consisting of transverse, linear, sub-parallel streaks, sending off numerous short processes at right angles, both streaks and processes being of a white colour, relieved by the darker mucous membrane. A magnified portion of this structure is given at fig. 2. This structure occupied nearly two inches of the uterine dilatation, which reassumed the longitudinal plications about one inch before terminating in the uro-genital compartment of the cloaca. The terminal outlet (*e*) is of a narrow elliptical form, with a tumid margin covering a sphincteric arrangement of the muscular fibres.

DESCRIPTION OF THE PLATES.

(The figures are reduced one half the natural size.)

Plate XXXI. Side view of the superficial muscles.

Plate XXXII. Side view of the second layer of muscles.

Plate XXXIII. Side views of the deeper seated muscles of the back and neck.

Plate XXXIV. Side and front views of the second layer of muscles of the neck.

Plate XXXV. Front view of the muscles of the Apteryx.

PLATE XXXVI.

The female organs of the *Apteryx australis*, nat. size.

Fig. 1 *a*. The right ovarium.

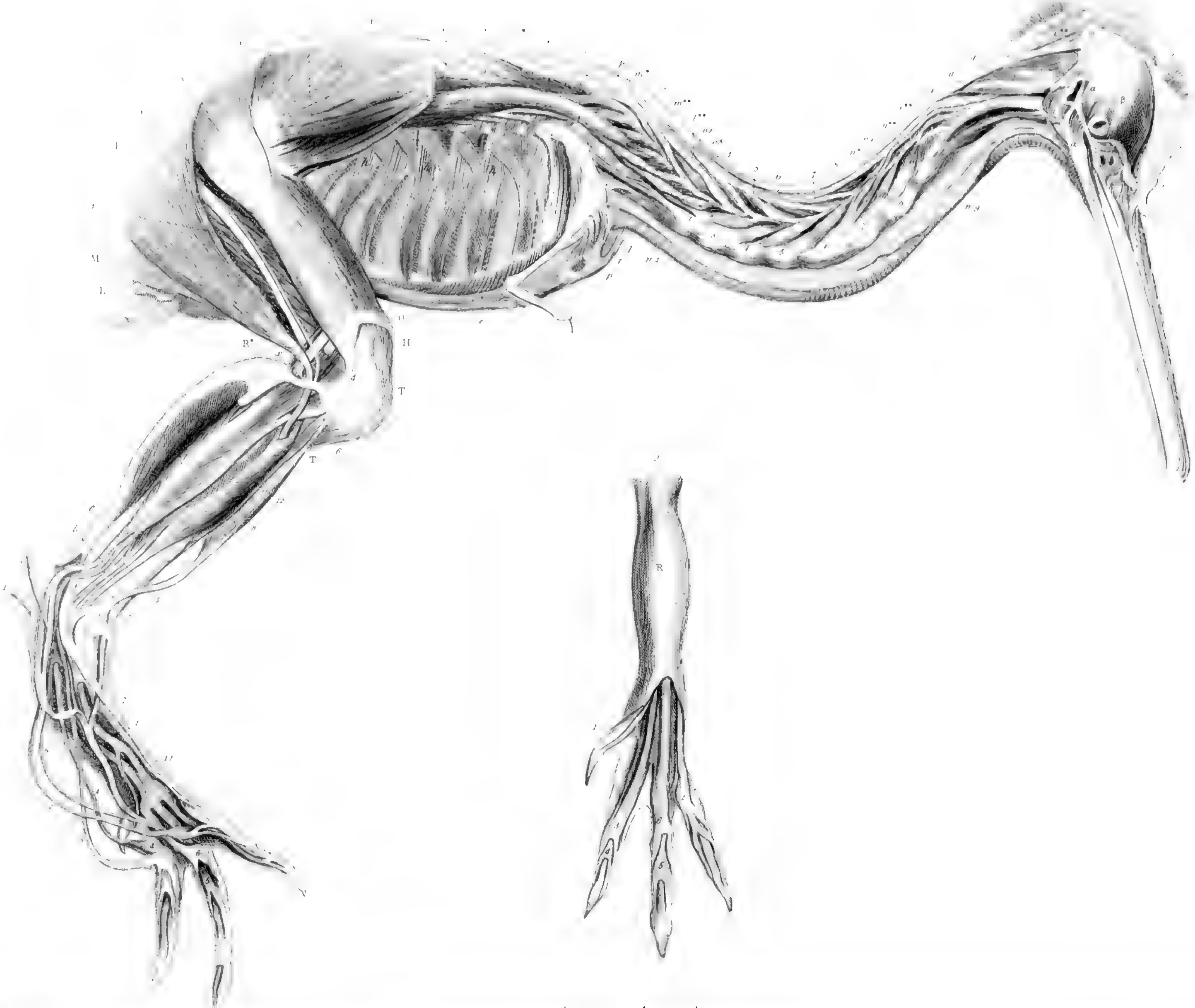
b. The left ovarium.

c, *d*, *e*. The oviduct: the uterine portion laid open and a probe passed into it.

Fig. 2. A portion of the lining membrane, showing the disposition of the secreting follicles of the egg-shell.

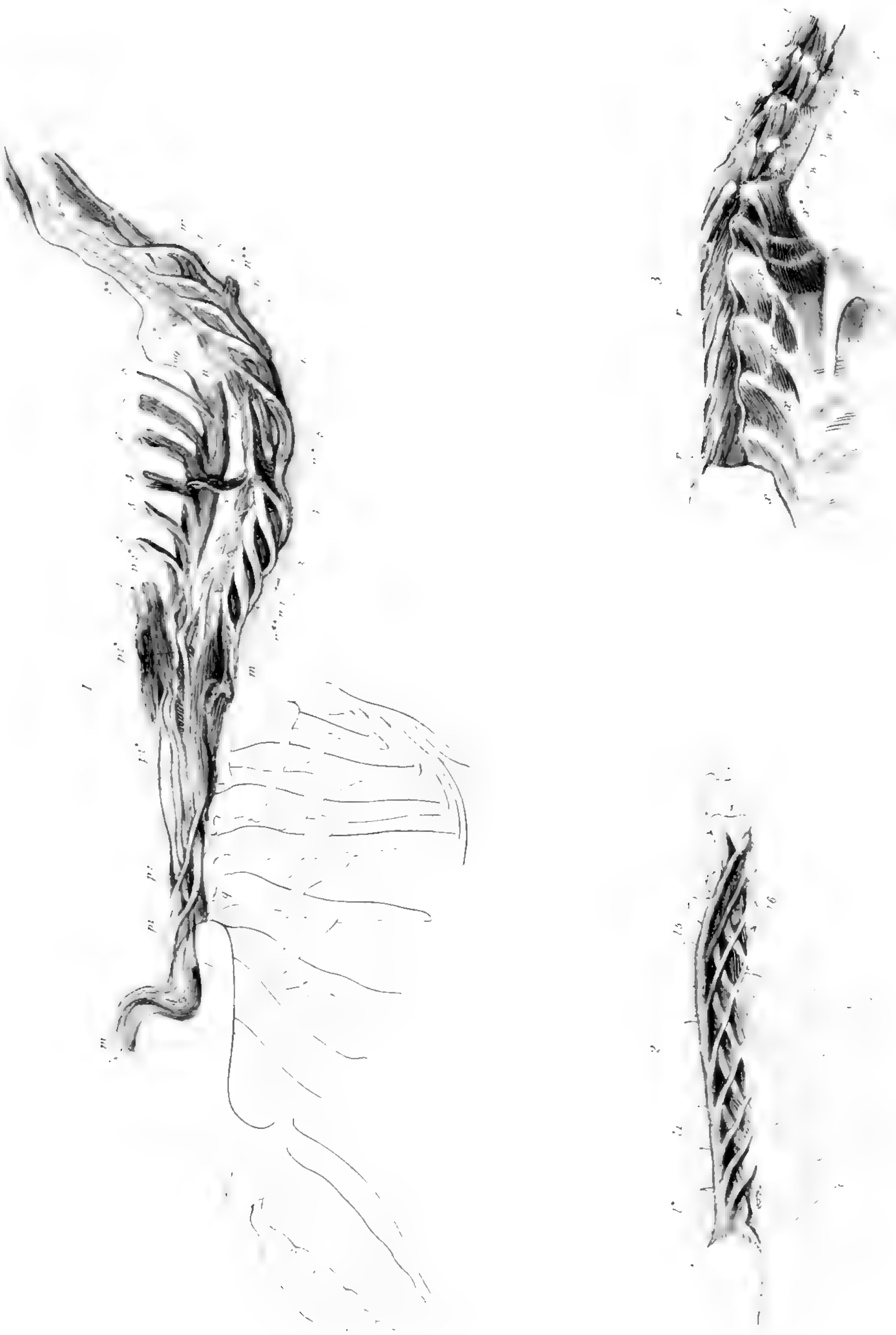
Apteryx Australis.

Scale [illegible] the natural size



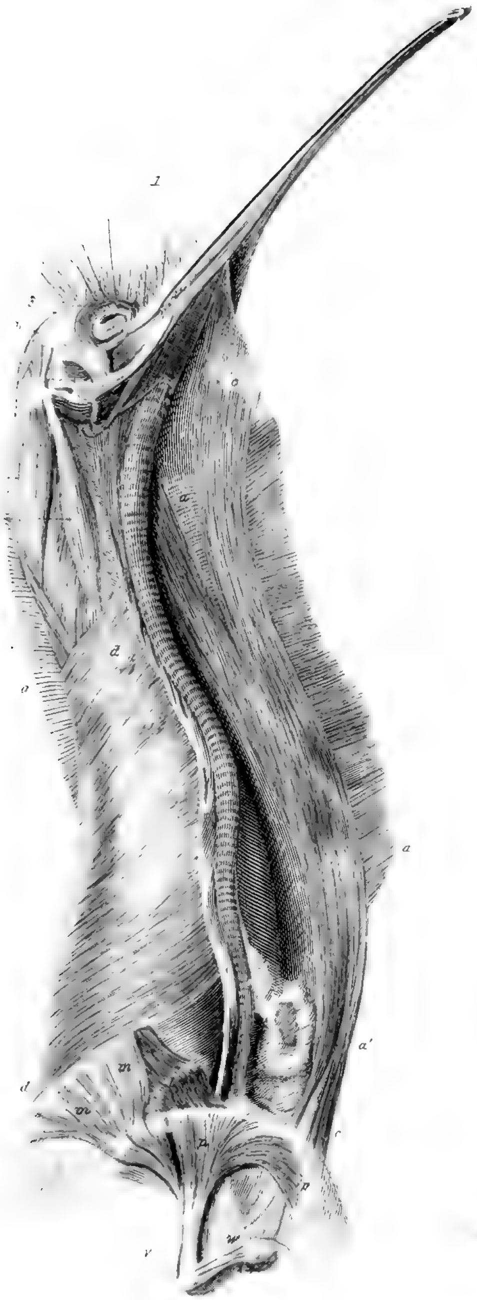
Apteryx Australis.

One 3rd the natural size



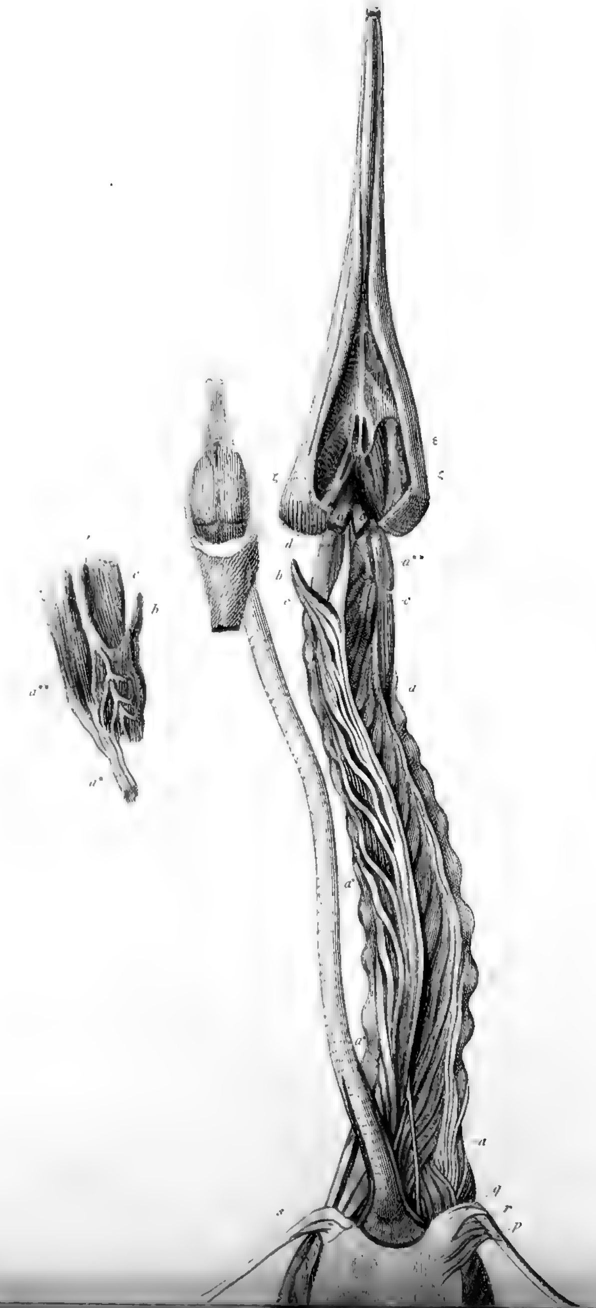
Apteryx Australis.

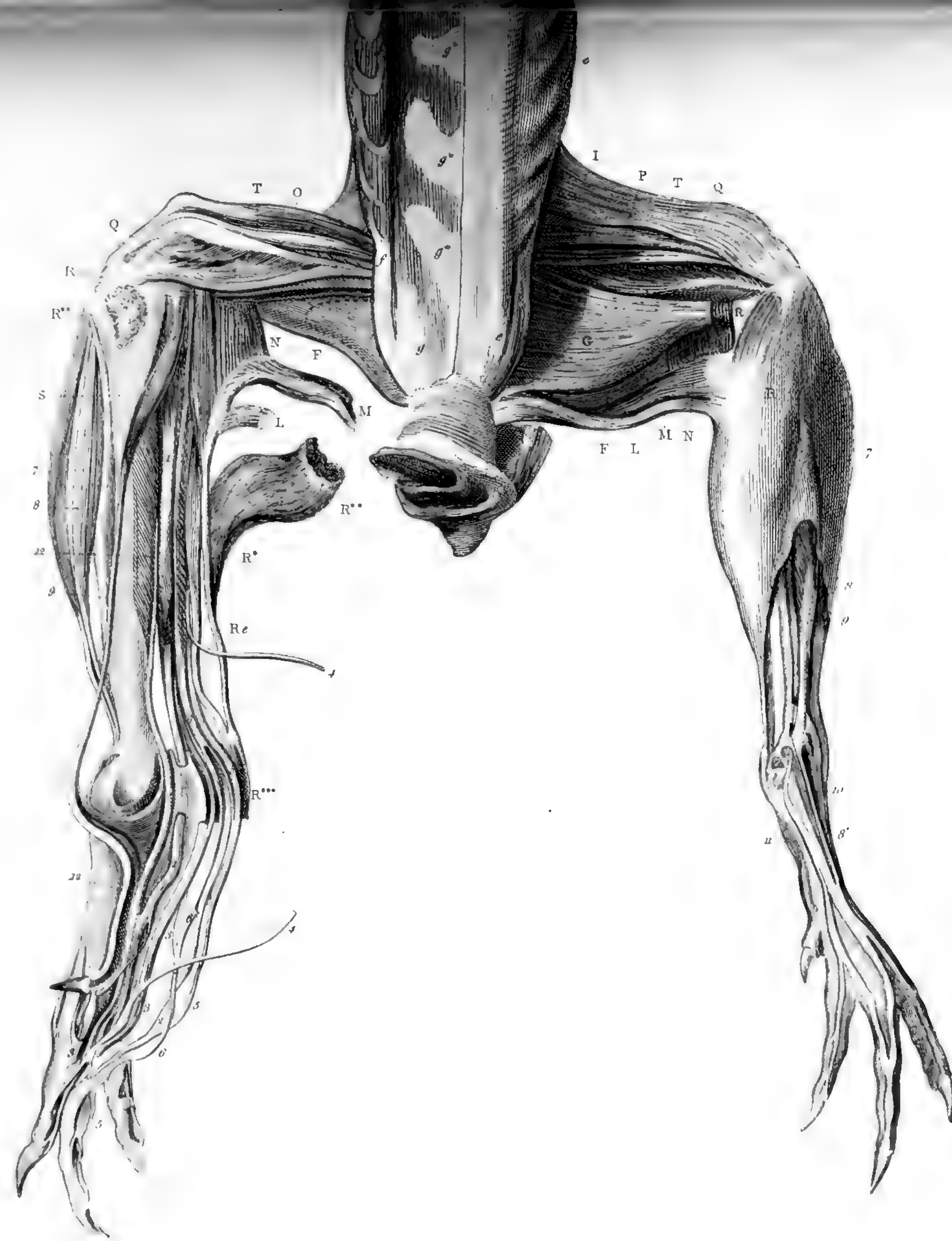
Scale 4ths the natural size.



Apteryx Australis.

Scale ⅔rds the natural size

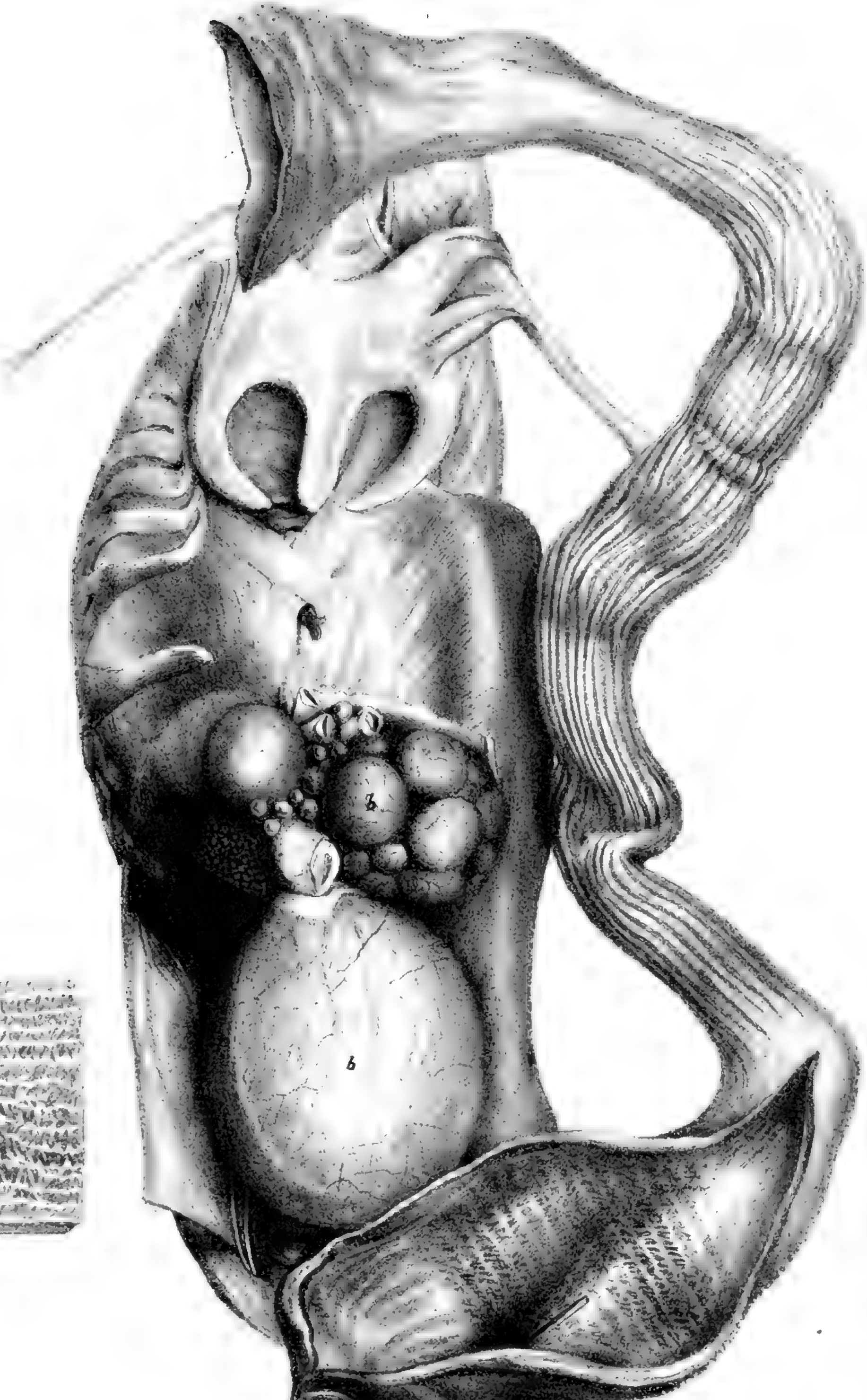


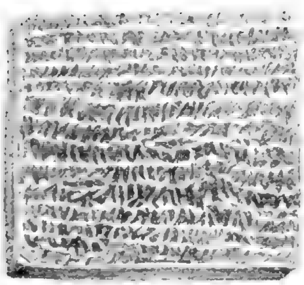


R. O. & W. Scharf. del.

Apteryx Australis.

J. Basire sc.





Apteryx australis

XII. *On the Osteology of the* Marsupialia. (Part II.)

Comparison of the Skulls of the Wombats *of Continental Australia and of Van Diemen's Land, whereby their specific distinction is established.*

By Professor Owen, *F.R.S., F.Z.S. &c.*

Read July 22, 1845.

In my former memoir on the Osteology of the Marsupialia*, the value, in the determination of the species of Marsupial Animals, of their osteological characters, and more especially of those derivable from the structure of the cranium, was attempted to be demonstrated: it is well-exemplified by the subjects of the following observations.

Skins of Wombats have been transmitted both from Australia and Tasmania, and may be seen in the National and Society's museums and in some of those abroad; but no observation has been made and recorded, to my knowledge, of any exterior character by which two species of the genus *Phascolomys* could be accurately recognized.

In fact, all the stuffed specimens of full-grown animals present nearly the same size, shape and colour; and as the few discernible differences may have been produced or exaggerated by accidental shrivelling and distortion of flexible parts in the drying and preparation of the skins, I shall here limit myself to the indication of those characters which are permanently impressed on the hard internal osseous framework.

It will be, unquestionably, of importance to the naturalist to compare closely the living Wombats of Australia, especially those from the southern province, with those from Van Diemen's Land. Hitherto the living specimens that have been exhibited in the menagerie of the Zoological Society have all been transmitted from Tasmania.

I have selected the skull of the largest of these Tasmanian Wombats (*Phascolomys Vombatus*, Auct., Plate XXXVII. figg. 1 & 2) to compare with the skull of a Wombat (Plate XXXVII. figg. 4 & 5) transmitted by Governor Grey, from South Australia, whereby the following differences, which prove their specific distinction, will be sufficiently obvious.

They are of equal size, but the skull of the specimen from South Australia (fig. 4) is broader in proportion to its length. In this continental species, which I propose to call *Phascolomys latifrons*, the upper incisors present a transverse semi-oval or rather reniform section (fig. 6, *a*), the convex enamelled surface being directed forwards and out-

* Zoological Transactions, vol. ii. 1841, p. 379.

wards: this surface is feebly striated longitudinally: the opposite or concave surface is impressed by a shallow longitudinal groove. The entire incisor is more curved than that of the *Phascolomys Vombatus*; *i. e.* it describes the larger segment (nearly one half) of a smaller circle (fig. 6, *b*). In *Phasc. Vombatus* the outer or enamelled surface of the upper incisor is indented by a shallow longitudinal groove, as well as the opposite side, which is the most convex transversely (see the transverse section, fig. 3, *a*). The entire incisor describes about one-fourth of a larger circle (fig. 3, *b*). The lower incisors are narrower in *Phasc. latifrons*, and trihedral (fig. 7, *c*); the enamelled anterior or under surface is flat; the outer surface longitudinally impressed, and almost devoid of enamel. In *Phasc. Vombatus* the lower incisors are also trihedral, but the outer surface is convex and enamelled; the entire teeth, and the symphysis of the jaw supporting them, are relatively larger (fig. 3, *c*). The first lower molar (premolar) is relatively larger, the last relatively smaller in *Phasc. latifrons.*

In this species the intermaxillary part of the skull is higher in proportion to its width, less convex externally (compare figg. 2 & 5). The nasal bones are relatively broader, forming the whole upper surface of the anterior third of the skull in *Phasc. latifrons* (compare figg. 4 & 1). The inter-orbital part of the skull is relatively much broader in *Phasc. latifrons*, and is produced on each side into a well-marked supra-orbital ridge and post-orbital process (fig. 4, *o*), both of which are almost obsolete in *Phasc. Vombatus* (fig. 1, *o*). The temporal fossæ are not bounded, as in *Phasc. Vombatus*, by two nearly parallel and remote longitudinal ridges, but are continued by a convex, rather irregular tract, to near the middle of the upper region of the cranium.

A very remarkable feature in the skull of the *Phasc. latifrons* is the supra-tympanic cell (fig. 5, *t*) excavated beneath the base of the zygoma: this cell in *Phasc. Vombatus* (fig. 2, *t*) is transversely oblong, simple, one inch by half an inch in size; in *Phasc. latifrons* it extends inwards one inch and a quarter, and expands to an antero-posterior diameter of one inch and a half, and a vertical diameter of one inch, having an oblong outlet nearly one inch in length and half an inch in depth, slightly contracted in the middle. This difference in the size of the supra-tympanic cell is obviously not the effect of age, as the skull of the *Phasc. Vombatus* compared is that of an old animal with strong temporal ridges.

In *Phasc. latifrons* the articular surface for the condyle of the lower jaw is broader and less convex; the anterior boundary of the zygomatic space is less angular; the palatal surface of the intermaxillaries is deeper; the curve of the lower border of the lower jaw is much deeper; the coronoid process (ib. *cr*) is higher and narrower, and the post-symphysial depression is almost obsolete.

Figures 1 and 4 show the characteristic differences in the upper surface of the skull of the two species, and figures 2 and 5 those observable on a side view, in which the curvature of the lower jaw of *Phasc. latifrons* (fig. 5) is a conspicuous character. Figures 3 and 6 show the difference in the form of the anterior bony aperture of the nostrils, and fig. 7 is a back view of the lower jaw of the *Phasc. latifrons,* showing the remarkable condyloid (*c d*), coronoid (*c r*) and angular processes, and the peculiar inward inflection of the angular processes (*a*). All the figures are of the natural size. For the original drawings I am indebted to Joseph Maclise, Esq., Member of the Royal College of Surgeons.

The geographical distribution of Australasian Marsupialia is shown in the following Table:—

SPECIES OF MARSUPIALIA

Peculiar to		Common to both.
Australia.	Van Diemen's Land.	
Dasyurus Geoffroyi.	Thylacinus cynocephalus.	Dasyurus viverrinus.
hallucatus.	Dasyurus ursinus.	Perameles obesula.
Phascogale crassicaudata.	maculatus.	Phalangista Cookii.
macroura.	Phascogale leucopus.	Macropus major.
murina.	minima.	Phascolomys Vombatus.
albipes.	Swainsoni.	
leucogaster.	Perameles Gunnii.	
flavipes.	Phalangista nana.	
apicalis.	fuliginosa*.	
calura.	Hypsiprymnus (Bettongia) cuniculus.	
penicillata.	Macropus (Halmaturus) Billardieri.	
Myrmecobius fasciatus.	(Halmaturus) Bennettii†.	
Chœropus castanotis.		
Tarsipes rostratus.		
Perameles Bougainvillei.		
myosurus.		
fasciata.		
nasuta.		
macroura.		
lagotis.		
Acrobata pygmæa.		
Petaurus Ariel.		
breviceps.		
sciureus.		
australis.		
taguanoides.		
Phalangista Neillii.		
concinna.		
canina.		
xanthopus.		
vulpina*.		
Hypsiprymnus (proper), 1 species.		
(Bettongia), 4 species.		
(Potorous), 3 species.		
Macropus (Heteropus), 4 species.		
(Lagorchestes), 4 species.		
(Halmaturus), 16 species.		
(proper), 3 species.		
Phascolomys latifrons.		

* *Phal. vulpina* and *Phal. fuliginosa* may prove varieties of the same species.

† Mr. Waterhouse, from whose excellent "Natural History of Mammalia" the species are cited, regards this as a variety of the *Halmaturus ruficollis* of Australia.

The mere record of species, irrespective of their relations, as it is the fundamental, so it is the lowest labour in zoological science. The present addition to the genus *Phascolomys* gives us a better insight into its typical characters, by showing the extent and kind of the variations in the skulls of two existing species. The geographical relations of the *Phascolomys Vombatus* and *Phasc. latifrons* will be interesting and suggestive if further researches should prove the first to be restricted to the island of Tasmania, and the second to the continent of Australia. With regard to other Australasian species of Marsupialia, the number that is common to Australia and the neighbouring island of Tasmania is remarkably small, as will be seen by the preceding table.

With regard to the extensive tribe *Poëphaga* (*Macropodidæ* and *Hypsiprymnidæ*), certain subgeneric groups have particular localizations; thus *Potorous*, *Heteropus*, and *Hypsiprymnus* proper, are peculiar to continental Australia. Certain well-defined genera are also restricted in their present geographical range, as shown in the following Table:—

GENERA OF MARSUPIALIA

Peculiar to		Common to both.
Australia.	Van Diemen's Land.	
Myrmecobius. Chœropus. Tarsipes. Acrobata. Petaurus. Phascolarctus.	Thylacinus. Sarcophilus (Dasyurus ursinus, Auct.).	Dasyurus. Phascogale. Perameles. Phalangista. Hypsiprymnus. Macropus.

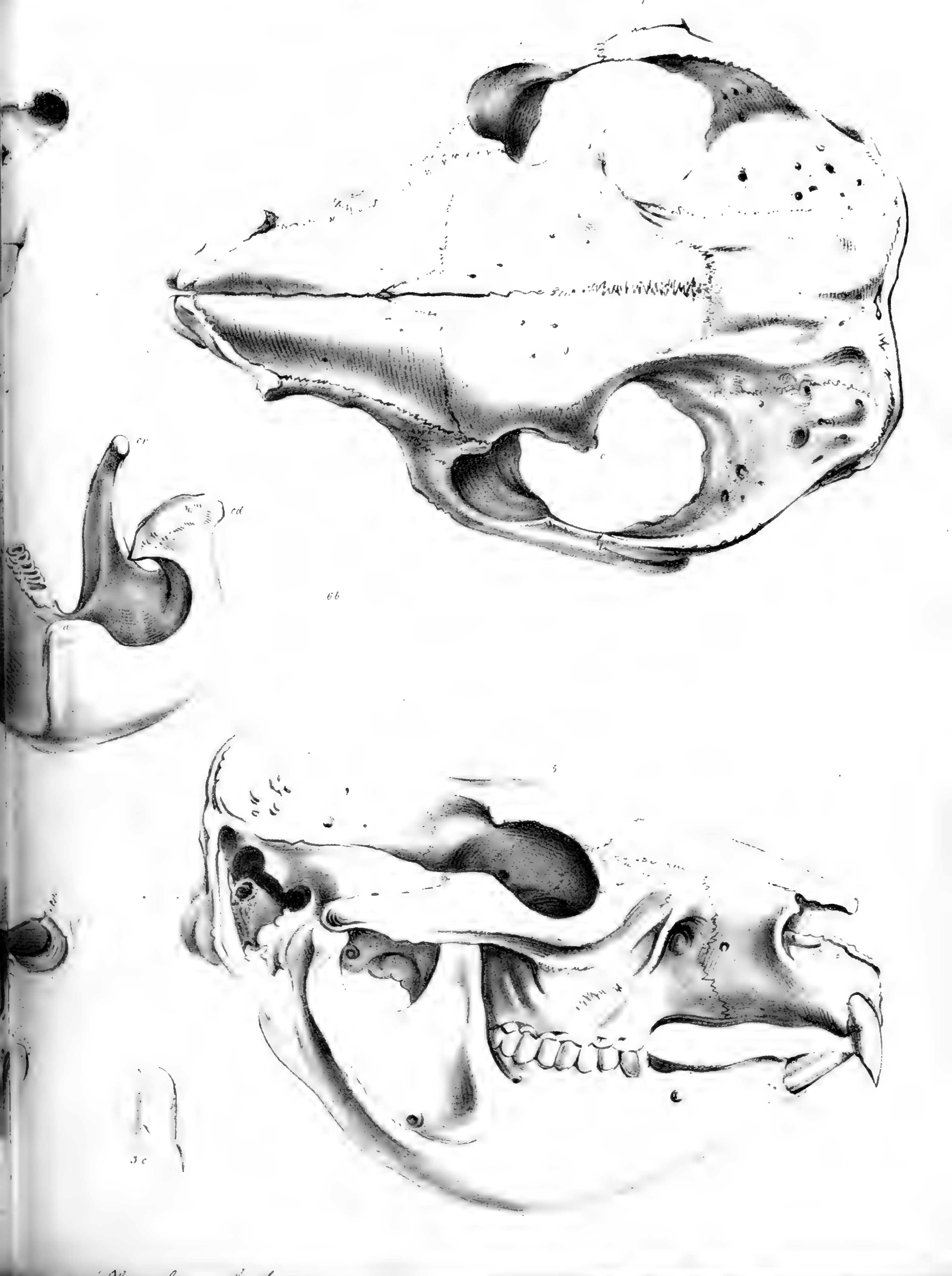
But it was not always so: fossil remains of extinct species of *Thylacinus* and *Sarcophilus* have been found in the ossiferous caverns of Australia. The extinct continental species of *Phascolomys*, which I have called *Phasc. Mitchelli*, much more closely resembles the Tasmanian *Phasc. Vombatus*, in the form and degree of curvature of the upper incisors, than it does the *Phasc. latifrons*. I have recently obtained evidence from the post-pliocene deposits of the district of Melbourne, through the kindness of my friend Dr. Hobson, of an extinct Wombat, a true *Phascolomys*, at least four times as large as either of the known existing species.

Fossil remains of more gigantic extinct forms of Marsupialia (*Diprotodon*, *Nototherium*) are described in my 'Odontography*' and 'Catalogue of Fossil Mammalia in the Museum of the Royal College of Surgeons†.' These genera have hitherto been found only in Australia; they combined some characters now peculiar to *Macropus* and *Phascolomys*.

* Vol. i. 4to, p. 394.

† 4to, 1845, pp. 291—323, pl. 6—10.


3 b
2


cr
cd
6 b
3 c

XIII. *On* Dinornis (Part II.), *containing Descriptions of portions of the Skull, the Sternum and other parts of the Skeleton of the species previously determined, with osteological evidences of three additional Species, and of a new Genus,* Palapteryx. *By* Professor Owen, *F.R.S., Z.S. &c. &c.*

Read June 23, 1846.

THE publication of the Memoirs on *Dinornis*, communicated to the Society in 1839 and 1843, has been followed by the collection in New Zealand, and the transmission to this country of many additional and highly interesting parts of the skeleton; some referable to the species of *Dinornis* therein defined, some to species of which no remains have hitherto been described, and others indicative of a new genus of gigantic wingless Birds.

The specimens in question have been discovered not only in the 'North Island' of New Zealand, from which those previously described were exclusively obtained, but also from the 'Middle Island,' or as it is sometimes termed, the 'South Island'; and all the bones from this locality are less altered, and appear to be much more recent than those from the North Island. The friendly correspondents through whose kindness I am indebted for the rich additional materials which form the subject of the present memoir, or for information respecting the Dinornis, are Captain Sir Everard Home, Bart., R.N.; the Hon. Wm. Martin, Chief Justice of New Zealand; Sir Wm. Hooker, F.R.S.; the Ven. Archdeacon Williams, Corr. Z.S.; William Swainson, Esq., F.R.S., F.L.S., the distinguished naturalist; Colonel William Wakefield; J. R. Gowen, Esq., a Director of the New Zealand Company; Rev. William Cotton, M.A.; Rev. Richard Taylor, M.A.; the Rev. William Colenso*, M.A.; Dr. Mackellar; and Percy Earl, Esq.

I propose first to describe the bones, the homologues of which have not before been described, and which extend our knowledge of the generic characters of the skeleton of the Dinornis, and afterwards those which characterise additional species.

Amongst the specimens of parts of the skeleton not before obtained, are two mutilated crania, defective unfortunately in the mandibles, and showing little more than the walls of the cranial cavity; but, nevertheless, highly interesting and instructive. The larger specimen (Plate XXXVIII. figg. 1—4) was obtained by the Ven. W. Williams from the bed of a mountain-stream descending to the coast at Poverty Bay, North Island, and is

* This gentleman has published a very instructive and interesting memoir on the Moa (*Dinornis*) in the Tasmanian Journal, No. VII. 1843, to which the editor has appended an abstract of my memoir in 'Zool. Trans.' vol. iii. p. 32. Mr. Colenso's memoir is reprinted in the 'Annals of Natural History,' August 1844.

referable by its size to the *Dinornis struthoides*. The smaller specimen (Pl. XXXIX. figg. 3—6) was obtained by William Swainson, Esq., from the North Island, probably in the vicinity of the Bay of Islands, and has belonged to a species distinct from the preceding, and agreeing in size with the *Dinornis dromioides*. Both specimens have the ferruginous tint and great weight, arising from infiltration of a salt of iron (peroxide), which characterized the specimens from the North Island described in the former memoir; but the cancelli of the bone contain only a little of the dry powdery alluvium of the streams into which the specimens have been washed.

Cranium.

The cranium referred to *Dinornis struthoides* agrees pretty closely in size with the same part of the skull of the Ostrich, as will be seen by reference to Plate XXXVIII., in which it is figured from four points of view, of the natural size; but it is broader in proportion to its height, especially in the occipital and inter-orbital regions. It is, in fact, remarkably depressed, subquadrate, with two large lateral emarginations for the temporal fossæ (*ib.* 6, 6), and both in size and shape it is more like the corresponding part of the head of the Dodo (*ib.* fig. 5) than that of any existing Struthious species: but the upper surface of the cranium of *Dinornis* is gently and equably convex above, the cerebral hemispheres not raising their bony covering above the level of the rest of the calvarium, as in the Dodo; and the frontal region, though more elevated than in the existing Struthious birds, is less suddenly raised than in the Dodo. The length of the present fossil is three inches, but half an inch at least of the anterior border of the os frontis has been broken away: its breadth across the mastoids is three inches and a quarter, but the breadth across the post-orbital angles appears to have been greater. The breadth between the temporal fossæ, which are large and deep, is two inches five lines; its vertical diameter at the deepest part, from the upper occipital ridge to the under surface of the basi-sphenoid, is one inch and a half. From the occipital region the depth of the cranium gradually decreases to the anterior boundary of the cerebral cavity. The great occipital foramen (fig. 1, 1″) is subcircular, and seven lines in diameter,—that of an Ostrich being five and a half lines across: its plane is vertical, and the single occipital condyle (*ib.* 1) projects freely backwards, upon a short peduncle, beyond the upper margin of the foramen. No existing bird presents this peculiarity: the Dinornis in this respect resembles some of the Chelonian Reptiles. The broad and low occipital surface of the skull slopes forwards as it rises to join the upper surface. This inclination, with the slight depth and great breadth of the occiput, and the almost flat upper surface of the skull, forms the most peculiar features of the present cranium. The occipital region above the *foramen magnum* is divided by three short obtuse vertical ridges into four depressions (fig. 3, *d*), the two median ones being half the breadth of the two lateral ones, which are deeper than usual: each depression is bounded above by a curved border, which does not rise above the level of the calvarium to form a crest, but defines by a festooned line the occipital from the coronal surface. A broad and deep depression separates the condyle on each side from the par-occipital processes (4, 4) which form the posterior boundary of the tympanic cavity (fig. 4, 28). The broad basi-sphenoid descends vertically for a third of an inch below, and at right angles with, the basi-occipital, separated from the condyle by two small but deep depressions; this development of the base of the skull is peculiar to the *Dinornis* among Birds, and resembles that in the Crocodile.

All the sutures of the cranium are obliterated, but the foramen for the third division of the fifth nerve shows that the ali-sphenoid (figg. 2 & 4, 6) ascended, as in other birds, to meet the parietal (*ib.* 7), in order to form the so-called temporal fossa. The upper boundary of each temporal fossa is well-defined, but not elevated into a ridge: a smooth and very slightly convex surface of the cranium, one inch and ten lines in breadth, intervenes between them: a continuation of the same surface, a flattened tract formed by the parietal and mastoid (fig. 3, 8, 8), four lines in breadth, separates the temporal (6) from the occipital fossæ (*d*). A cellular air-diploë, from two to six lines thick, divides the outer from the inner table of the cranium.

The mutilated base of the present specimen exposes the upper border of the pituitary depression, bounded posteriorly by the groove in the basi-sphenoid (fig. 4, 5) common to the converging carotid canals, and anteriorly by the groove which lodged the optic chiasma, and from which the optic foramina (fig. 4, *o*, *o*) are continued outwards and forwards to the orbits (11′, 11′). The outlets of the optic foramina are separated by an interspace of one inch: the Apteryx, amongst existing birds, approaches nearest to the Dinornis in this peculiarity; but the Dodo most probably still more closely resembled the Dinornis in the distinctness of and distance between the external outlets of the optic canals. These foramina, in the present cranium, are smaller than those in the skull of the Ostrich, and indicate it to have had smaller eyes, in which respect it must have resembled the Dodo. The olfactory foramina are subcircular, three lines in diameter, single, on each side, as in other birds, and at the anterior end of the cranial cavity separated by an interspace of two lines: the olfactory cavities (fig. 4, 18) extend backwards behind these foramina, upon the under surface of the cranium, to within four lines of the optic groove, a feature which, with the large size of the olfactory nerves, indicates a development of the organ of smell approaching that most remarkable one in the Apteryx. Of the other outlets of the cerebral nerves, those for the ninth pair (the pre-condyloid foramina, see fig. 1) are alone remarkable for any increase beyond the ordinary size. The foramen rotundum (*n*, *n*, fig. 4) is distinct from both foramen ovale and foramen opticum. The articular depression (fig. 4, 28) for the tympanic or quadrate bone is imperforate, eight lines long, from three to four lines wide, bounded externally by a short angular process of the mastoid.

The form of the inner surface of the cranium shows that the cerebral hemispheres were smooth, low, not rising higher than the cerebellum, but convex and expanded anteriorly: the proportion of the cavity to its great posterior outlet indicates the brain to have been smaller in proportion to the spinal chord than in any Struthious or other existing bird. There is no bony falx: the vertical ridge on the fore-part of the 'os petrosum,' for the attachment of the tentorium, is less produced than in the Apteryx: there are no horizontal ridges of bone continued forwards from the os petrosum to define the fore and upper part of a fossa for the optic lobe on each side, as in the Ostrich and most other birds.

The depressions on the occiput for the insertion of the nuchal muscles indicate the force with which they must have habitually operated upon the head; and the unusual size and depth of the temporal fossæ equally indicate the great strength of the gripe of the bill: such a combination of powerful muscles of the head and the beak accords with the indications which the vertebræ of the neck and the short and strong metatarsi afford, of habits of scratching and uprooting vegetables for food.

Compared with the Ostrich, the occipital condyle is smaller in the *Dinornis* in proportion to the great foramen: the cranium of the Ostrich is narrower, loftier and more convex posteriorly, and much more contracted anteriorly. The form of the cerebral hemispheres must have differed greatly in the two gigantic Struthious birds here compared. In the Ostrich the cerebrum is pyramidal, tapering forwards to a point; in the Dinornis it must have been square-shaped and broadly convex anteriorly.

Amongst the Grallatorial birds the cranium of the Gigantic Crane (*Ciconia Argala*) alone equals the present fragment in size, and resembles it in the expanse and degree of convexity of the upper surface; but it differs, like the Ostrich, in having a more sessile occipital condyle, which is larger in proportion to the foramen: the plane of the foramen inclines in the Argala, as in most other existing birds, from below upwards and backwards; and there is a similar inclination in the plane of the supra-occipital surface, which more nearly than in the Ostrich equals in breadth that of the Dinornis; but it is of greater height. The under part of the occipital condyle is on a level with that of the basis cranii in the Argala, as in most other birds: in the Dinornis it is raised above that level, or rather the level is carried by the above-mentioned development of the basi-sphenoid below it. The supra-occipital crest is more developed in the Argala, and the upper part of the skull is indented anterior to it. The temporal fossæ are much smaller, and more posterior in position, extending to the occipital ridge in the Argala. The optic foramina are more approximated and the cranial cavity is more contracted anteriorly in the Argala. The articular cavities for the quadrate bones are perforated, and more transverse in position in the Argala, as in the Ostrich, than in the Dinornis. The anterior condyloid foramina in both the Argala and the Ostrich are scarcely half the size of those in the Dinornis, and are situated nearer the condyle.

The Apteryx has a more hemispheric occipital condyle than the Dinornis, and the plane of the occipital foramen differs in the same degree from that of the Dinornis, in regard to its slope, as in the Argala and Ostrich: the occiput in the Apteryx is narrower, higher, almost vertical, with the middle part produced backwards into an angular projection and perforated on each side: the upper region of the head is much more lofty and convex than in the Dinornis; the mastoid process is much smaller in proportion to the par-occipital process: the temporal surfaces resemble those in the Dinornis in their antero-posterior extent, but do not impress the sides of the cranium; the orbits are much smaller, and the olfactory cavities much larger in the Apteryx than in the Dinornis; but it is interesting to find the nearest approach to these peculiarities of the existing Struthious bird of New Zealand made by the extinct *Struthionidæ* of the same island.

The cranium of *Dinornis*, referable by its size to the *D. dromioides*, was kindly transmitted, with other bones of the same genus, for my examination by Mr. Swainson*. It has suffered nearly the same kind and degree of mutilation as the larger cranium; the basi-sphenoid, with all the rostral part of the skull, having been broken away; but the supra-orbital ridges and fore-part of the frontal region of the cranium are more entire (Plate XXXIX. figg. 4—6). The breadth of the cranium across the mastoids is two inches, seven lines; the length to the anterior border of the os frontis (not entire in the larger specimen) is two inches, eight lines; the breadth across the post-orbital angles is two inches, two lines; the breadth between the temporal fossæ is one inch, nine lines.

The smaller size of the present cranium, as compared with the preceding specimen, does not depend upon the immaturity of the individual: not only are the sutures almost as completely obliterated (and this takes place much later in Struthious birds than in birds of flight), but the ridges defining the attachment of the muscles are as strongly marked, and indicate not only a full-grown but an old bird.

The large size and vertical plane of the foramen magnum; the broad, low, supra-occipital region (figg. 4 & 5, 3), sloping from below upwards and forwards; the almost flat parietal surface (*ib.* 7), continued directly forwards into the broad, downward sloping frontal region (*ib.* 11); the wide and deep temporal fossæ (*ib.* 6); the small orbits (*ib.* 11′) and expanded olfactory chamber (fig. 6, 18);—all repeat the peculiar generic characters of the cranium of *Dinornis* which are exhibited in the larger specimen.

The specific distinction of the smaller cranium is shown by the less produced and sessile occipital tubercle (figg. 4 & 5, 1); by the absence of the two fossæ on the back-part of the descending plate of the basi-occipital; by the wider temporal fossæ, divided behind from the occipital surface by a common ridge (fig. 5, *r*), not by a flattened tract;—and if the value of this difference should seem to be diminished by the known changes in the development of the temporal muscles in the progress of age, it applies in the present instance in favour of the specific distinction of the smaller cranium; for the less

* In the note accompanying the specimens that eminent ornithologist says, "They are from the North Island. . . . . . I have no idea that this strange group of Birds is any longer in existence, notwithstanding all the stories of the natives and others. If any may be alive they will probably be found in the Middle Island, which may be almost said to be uninhabited, except on the coast."

extent of the temporal fossa and the concomitant distance of its boundary from that of the occipital fossa, which might be interpreted as characters of immaturity, are present in the larger, not in the smaller cranium; and they are associated also in the larger cranium with a development of muscular ridges and impressions which forbid the supposition that that cranium has belonged to a young individual of the gigantic *Dinornis*. I conclude therefore that the *Dinornis dromioides* had relatively larger temporal muscles and a stronger bite than the *Din. struthoides*. The upper boundaries of the depressions are better defined in *Din. dromioides*, and there is a vertical ridge marking off the anterior third of the depression (*ib.* 6), like that which may be seen in the cranium of the large Storks and some other birds, but of which there is no trace in the cranium of *Din. struthoides*.

The articular surface on the mastoid for the os tympanicum is broader, flatter and shallower anteriorly in *Din. dromioides* than in *Din. struthoides*; and, in both, the lower angle of the mastoid is much less produced below the outer side of the articular cavity than in the Ostrich or Emeu; but the mastoid process in the Apteryx is much less in comparison with the par-occipital process than it is in the Dinornis.

The posterior angles of the supra-orbital ridge (*ib.* 12) are not entire; but the rugged surface has more the character of a sutural than a fractured one; and the presence of distinct posterior frontals in a nearly mature skull of an Emeu (*Dromaius Novæ Hollandiæ*) (*ib.* fig. 1, 12, 12) at the same part, leads me to suspect that these parapophysial elements of the frontal vertebra may have remained permanently separate osseous pieces in *Dinornis*, as in the Reptilia.

The anterior border of the os frontis shows two deep angular depressions (fig. 5, 15) for the articulation of the nasal bones, which are thus proved not to have become anchylosed to the frontals, as in the Apteryx, Emeu, and most other birds, but to have remained distinct throughout life, as in the Turkey and some other *Gallinacea*.

The extent of the supra-orbital ridge is eleven lines, and is, therefore, proportionally much less than in the Emeu or any Struthious bird, except the Apteryx, and apparently also the Dodo: the very slight transverse concavity of the roof of the orbit (fig. 4, 11′) and its longitudinal convexity are characters which are intermediate between those of the Apteryx, where the orbital cavity is singularly small and indistinct, and those of the larger existing *Struthionidæ*, and they combine, with the diameter of the optic canals, to show that the eyes of Dinornis were relatively smaller than in the Emeu and Ostrich.

Part of the inter-frontal suture, usually the last of the proper cranial sutures to disappear, may still be seen in the outer table of the skull of the *Dinornis dromioides*: there is no trace of it in the skull of the *Din. struthoides*.

Tympanic Bone.

The third portion of a skull formed part of a small collection of bones of *Dinornis* from the North Island, transmitted by my esteemed friend the Rev. William Cotton, M.A., whose zealous co-operation in the advancement of the natural history of the remote colony which benefits by his more important labours, deserves the warmest praise.

The portion in question is the left os tympanicum (os quadratum of ornithotomists), with the upper or mastoid articular end broken away, but with the orbital process and inner part of the articular surface for the mandible entire (Plate XXXIX. fig. 7). From its size, which is double that of the same bone of the Ostrich (*ib.* fig. 8), it is referable to the *Dinornis giganteus*. In the breadth and flatness of the articular surface (*c*) for the inner division of the mandibular condyle, it resembles the tympanic of the Emeu more than that of the Ostrich; but in the length and slenderness of the orbital process (*a*) it more resembles the Apteryx (fig. 9, *a*) than any other existing Struthious bird. The corresponding process in the tympanic of the Ostrich and Emeu is shorter and broader. The upper articular extremity is wanting in the fossil, but its shape may be judged of by that of the cavity in the skull (Pl. XXXVIII. fig. 4, 28) adapted for its reception. The figures preclude the necessity of further verbal description of the present interesting fragment: if the length of the entire skull bore the same proportion to the os tympanicum in the *Dinornis giganteus* as in the Ostrich or Emeu, it could not be estimated at less than one foot three or four inches in the stupendous extinct wingless bird of New Zealand; but if the form of the beak should have resembled that of the Dodo or approximated to that of the Apteryx, the total length of the skull of the *Dinornis giganteus* would exceed the above-estimated admeasurement.

Vertebræ.

Through the kindness of Dr. Mackellar I have been enabled to compare and describe some remarkably perfect specimens of cervical and dorsal vertebræ of the *Dinornis*, which formed part of a collection of bones obtained by that gentleman in the Middle Island, from a superficial turbary formation on the coast, submerged at high tide, near the settlement at Waikawaite: these specimens are now deposited in the Museum of Natural History of the University of Edinburgh.

The first of these vertebræ (Plate XL. figg. 1, 2 & 3) to be noticed is a cervical, with all its parts as sharp and unmutilated as if it had been artificially macerated. From the absence of a neural spinous process, as well as from the longer and more slender proportions of the body, compared with any of those described and figured in the former memoir (Zool. Trans. vol. iii., Pl. XVIII., pp. 259—261), the present vertebra must have come from a more advanced part of the neck, and have belonged to a species at least as large as the specimen in Pl. XVIII. figg. 1—3. From the analogy of the Apteryx it might be the eighth or ninth cervical, since in that bird the spinous process begins to be developed in the vertebræ above and below these; but the proportions of the vertebræ and the analogy of the Emeu indicate it to have come from a part nearer the head.

In the length of the posterior zygapophyses or articular processes (Pl. XL. *z'*) and the depth of the triangular depression between them, the present vertebra bears more resemblance to the cervical vertebræ of the Emeu than to any in the neck of the Ostrich, the Rhea, or the Apteryx: but the pleurapophysis or process representing the cervical rib (*ib. pl*) is not so pointed or prolonged as in the Emeu; it more resembles that in the Apteryx: the breadth or depth of this process, the large relative size of the canal which it overarches and completes, and the ridges and furrows on the outer surface, bespeak the strong development of the cervical muscles and the great strength of the neck.

The characteristic conformation of the cervical vertebræ in the class of Birds is well-displayed in the present specimen, and the particular modifications characteristic of the Dinornis are better elucidated by the figures than by verbal description.

The next cervical vertebra (Pl. XL. figg. 4 & 5), like the foregoing, is from the part of the neck where the neural spinous process ceases to be developed, there being in its place a flat surface (*s*) behind a rough shallow depression for the attachment of the strong, short, elastic ligament: the difference of size and conformation of the present, as compared with the foregoing vertebra, is obviously not such as depends on mere difference of position in the same neck, or in the neck of the same species, but clearly indicates a difference of species in the birds to which they have respectively belonged. The present vertebra may well, from its size, have come from the anterior third part of the cervical series in the *Dinornis giganteus*; the preceding from the corresponding part of *Dinornis ingens*. In assigning the vertebra (Zool. Trans. vol. iii. Pl. XVIII. figg. 1—3, p. 271) to the largest species of *Dinornis*, I was influenced by the ordinary proportions of those bones in other birds: the present specimens prove that the strength of the neck was greater and the cervical vertebræ relatively larger in the genus *Dinornis*, and the above-cited vertebra must be assigned to *Din. ingens* rather than to *Din. gigas*.

The costal process (Pl. XL. *pl*) here presents a similar breadth and depth and external sculpturing: the upper and posterior margin is produced into a short obtuse point. From the base of this part a ridge extends obliquely upwards and backwards to that of the posterior zygapophysis or oblique process (*ib. z'*), parallel with the shorter and stronger ridge from the anterior oblique process (*ib. z*) to the base of the spine: between these ridges there is a deep depression opening at the bottom into the cancellous structure of the bone. This *foramen pneumaticum* is not present in the smaller cervical vertebra (*ib.* figg. 1—3). The rudimental spinous process (*ib.* fig. 5, *s*) forms a transverse barrier across the front of the depression between the posterior oblique processes, which depression is broader and more rounded at the bottom than in the preceding vertebra, and is quadrate, not triangular, in the present vertebra.

The largest vertebra in Dr. Mackellar's collection is an inferior cervical one, corresponding with that of the smaller species of *Dinornis* figured in Zool. Trans. vol. iii. Pl. XVIII. figg. 7, 8 & 9, in the presence, as in the Apteryx, of a compressed hæmal or inferior spinous process. In this character both species of *Dinornis* more resemble the small existing Struthious bird of New Zealand than the larger species of New Holland. In the Emeu, for example, the inferior spinous process begins not to be developed until the dorsal series of vertebræ, with articular cavities for ribs, commences.

The anterior articular surface of the body (Plate XLI. figg. 2 & 3, *a*) bends down upon the under part of the vertebral body, where the lower angles of the reniform surface are produced backwards. The diapophyses or transverse processes (*ib. d*) developed from the base of the anterior oblique processes (*ib. z*) seem not to have been connected by a costal process with the produced margins of the anterior and under part of the body (*a*), but to have been divided from these by an open groove on each side. The perforated depression (*i*, fig. 1) is smaller than in the foregoing cervical vertebra, and the posterior boundary ridge of the foramen pneumaticum is shorter and more obtuse. The base of the superior spine is strongly impressed before and behind by a rough surface for attachment of the inter-spinal elastic ligaments: the antero-posterior extent of this spine (*g*) and of the inferior one (*h*) is shown by dotted lines in fig. 1. Both having been broken off in the specimen, these and the other fractured surfaces of the vertebræ show the very coarse and loose cancellous texture of the bone.

In a similar-sized more perfect posterior cervical vertebra of *Dinornis giganteus*, in the collection of Mr. Percy Earl, obtained from the same deposit and locality, the strong spinous process is entire: it is four-sided and truncate at the summit, four inches high from the fore-part of its base, one inch in the antero-posterior diameter of the base, and ten lines in the transverse diameter.

A fragment of a vertebra, from the same collection, of nearly the same size, and probably a little anterior in position, differs from the preceding in having only a very shallow imperforate depression, where the deep perforated pit exists at the sides of the neurapophyses in the foregoing vertebra: the neural spine has scarcely been developed above the level of the posterior zygapophyses or articular processes in this fragment.

Dr. Mackellar's collection contained two very perfect specimens of dorsal vertebræ of smaller species of *Dinornis*, presenting several peculiarities characteristic of the genus. The first of these (Pl. XLII. figg. 1 & 2) is from the middle of the dorsal region of probably the *Dinornis ingens*. It is not carinate inferiorly, as in the corresponding vertebra of the smaller species, figured in Pl. XVIII. *a*, figg. 6—9, vol. iii., and the lower border of the anterior articular surface of the body is less produced in proportion to that of the posterior surface. The depression leading to the cancellous structure between the transverse and posterior oblique process in the small dorsal vertebra above cited is wanting in the present large one; but the pneumatic foramen (Pl. XLII. *f*) between the costal depression (*c*) and transverse process (*b*) is present. The proportionate breadth of the body of the vertebra; the broad outspread oblique processes (*ib.* fig. 2, *z*, *z'*); the thick, obtuse and almost horizontal transverse processes (*ib. b.*); the strong spinous process, as broad transversely as antero-posteriorly;—all exemplify the generic characters of the vertebræ of *Dinornis*.

The rough ligamentous tract on the fore and back part of the neural spine is produced into a median ridge (*s*), making the transverse section of the middle of the spine hexagonal; two inches and a half of the spine remain, measured from the bottom of the rough tract; the height would probably have exceeded three inches in the perfect vertebra.

A dorsal vertebra (Pl. XLII. figg. 3 & 4) of the same size, and from the same or nearly the same region of the spine, shows the pneumatic foramen between the transverse and posterior articular process, as in the small vertebra (vol. iii. Pl. XVIII. *a*, figg. 6—9); and it further differs from the vertebra, Pl. XLII. figg. 1 & 2, by the larger proportional size of the zygapophyses (*ib. z, z*) and the somewhat more slender spine (*ib. s*): the ridge continued from the side of the base of the spine to the transverse process (*ib. b*) is sharper.

A middle or posterior dorsal vertebra of a smaller species of *Dinornis* resembles the larger one in the absence of the pneumatic foramen between the posterior oblique and transverse processes, and in the relative size of the posterior and anterior articular processes: the spine is entire, the rough front and back surfaces are not carinate, but convex; the summit of the spine flat and truncate.

The figures in Plate XLII. supply the points of comparison omitted in the verbal description, in a better and more applicable form. I suspect one of the larger dorsals to belong to the *Din. ingens*, the other larger one to the *Din. crassus*; the present vertebra may well belong to the *Din. struthoides*.

Sternum.

From the turbary deposit near Waikawaite Mr. Earl obtained nearly an entire sternum (Pl. XLIII. figg. 1—3) of one of the larger, if not of the largest species of *Dinornis*. It appeared to have been fractured by the instruments employed in digging out the bones, and reached me in two pieces, one including the articulations for the sternal ribs (*r, r*) and for the coracoid (*ib.* fig. 2, *c, c*) of the right side, with rather more than half the body of the sternum, and with the border of the right posterior wide notch (*e*) entire, showing its size and shape, but with part of the anterior border and the anterior (*a*) and posterior (*p*) angular processes broken away: the left portion of the same sternum included the two posterior articular surfaces for the ribs and upwards of three inches of the posterior angular process, with part of the entire border of the left posterior emargination (*e*): the base (*x*) of a process from the middle of the posterior border of the sternum indicated the characteristic configuration of this part of the bone. The anterior border (fig. 2), about half an inch thick, and rounded, is shown by the right moiety to have extended almost straight to beyond the middle of the bone. The outer surface of the sternum is gently convex, without the smallest trace of a median crest or keel; the inner surface is slightly concave, deepest near the anterior angles. The main body of the sternum consists of a light cellular layer of bone, with a thin, smooth, compact outer and inner table, the whole averaging three lines in thickness, and thinning off to the posterior margin.

The following are the dimensions of this mutilated but instructive bone:—

	In.	Lin.
Breadth across the articulation of the last rib	9	9
Breadth between ends of posterior angular processes	13	0
Length, or antero-posterior diameter at middle of posterior emarginations	6	0
Thickness at articular margin for ribs	1	0
Length of posterior angular process from middle of emargination	4	0
Extent of costal articular surface	2	6
Extent of coracoid articular surface	1	0

This, the largest sternum which has hitherto been discovered in the class of Birds, is relatively the smallest in proportion to the body, if it belong to the *Dinornis giganteus*. That it belongs to the genus there is no room for doubt, since it was found associated exclusively with the abundant remains of different species of *Dinornis*, and especially with those of *Din. giganteus*. In its small relative size, its shortness as compared with its breadth, its shield-shape and the total absence of a keel, it demonstrates the want of a power of flight in the genus *Dinornis*, and its closer relationship to the Cursorial or Struthious order. The following are comparisons of the present sternum with the modifications of form which that bone presents in the different genera of that strictly terrestrial order.

The sternum of the Ostrich (*Struthio*, Pl. XLIII. fig. 4) is larger in proportion to its breadth; the hind-part is narrower, instead of being, as in Dinornis, broader than the fore-part: the sternum of the Ostrich is more convex, and is a much thicker bone, especially at the middle prominent part of the body of the bone which transmits the weight of the trunk upon the sternal cushion or callosity, upon which the Ostrich rests when prone on the ground. The coracoid grooves (*ib. c, c*) are considerably larger in the Ostrich, extending from the outer angle, close to the middle of the anterior border, which is thin and sharp: the costal articulations (*ib. r*) are broader, much deeper, and occupy a much greater proportion of the lateral borders of the sternum. The posterior angles (*ib. p*) are prolonged backwards, but not so far as in the Dinornis, and there are two emarginations (*ib. e, e*) on each side between the angles and the middle line, to which a cartilaginous, and, in old Ostriches, a semi-osseous xiphoid appendage (*x*) is attached.

In the *Rhea* the sternum (Pl. XLIII. fig. 5) deviates more than in the Ostrich by its greater length, median convexity and posterior contraction, from that of the Dinornis: it further differs in the absence of posterior angular prolongations and the presence of a posterior median marginal notch (*e*); but the coracoid cavities (*c, c*), though considerably larger than in the Dinornis, are more confined to the anterior angles than in the Ostrich.

The coracoid cavities have a similar position, but rather smaller relative size, in the sternum of the Cassowary (*ib.* fig. 6), which however differs as much as that of the Rhea from the sternum of the Dinornis in its greater length as compared with its breadth, and especially in its contraction to the posterior margin, where the angles are rounded off and the middle part slightly produced.

In the Emeu (*Dromaius*) the sternum (*ib.* fig. 7), with the same general form as in the Cassowary, further differs from that of the Dinornis in the approximation of the coracoid grooves (*ib. c, c*) so as to come into actual contact at the middle of the anterior border.

Of the sternum of the Dodo we as yet unfortunately know nothing, although we may as reasonably expect the osseous remains of that extinct bird to reward the search of naturalists and collectors in the islands of Mauritius and Rodriguez, as the similar quest in New Zealand has been followed by the recovery of the bones of the *Dinornis*.

In the *Apteryx* however we find a sternum (*ib.* fig. 8), which, with the same general Struthious characters, very closely corresponds with the particular modifications of that of the Dinornis. It has the same small proportional size to the body; nearly the same superior breadth as compared with the length, the same slight degree of convexity, and the same characteristic expansion and marginal configuration posteriorly. In the sternum of the Apteryx described and figured in the Zoological Transactions, vol. ii. p. 290, pl. 55. figg. 2 & 3, two small subcircular spaces remained unossified in the body of the sternum; in two more mature specimens which I have subsequently received, ossification has obliterated these spaces, where however the bone is thin and diaphanous, and the sternum presents only the two deep posterior emarginations, bounded by a middle xiphoid prolongation and the two angular elongated processes (*p, p*), as in the Dinornis. These processes in the Apteryx are relatively broader, thinner, and are subincurved: in the Dinornis they seem, from the remains of the one on the left side, to be straight, and become thicker and narrower.

The costal articular surface occupies a greater proportion of the lateral margin of the sternum in the Apteryx than in the Dinornis, though it is less than in the Ostrich. The coracoid groove has the same relative position and size in the Apteryx as in the Dinornis, but has a different form: in the small existing wingless bird it is an oblique notch, formed by a small process projecting upward and forward from the outer surface of the sternum near the antero-external angle: in the Dinornis (*ib.* fig. 2, *c*) it is an oblique depression, as if the end of the thumb had been pressed into the same part of the bone when soft. The anterior and lower border of the depression is not produced beyond the level of the bone; but in the example before me it is notched, as if for the passage of vessels to the joint.

Whether the antero-external angle (*a*) is prolonged so far in *Dinornis* as in *Apteryx*, the fracture of that part in the present specimen does not allow to be determined. The anterior margin between the coracoid articulations in the Apteryx is deeply excavated, whilst in the present species of *Dinornis* it is almost straight. Four smooth depressions with three well-marked rough surfaces (r, r', r'') for the attachment of sternal ribs, characterise the anterior two-thirds of each lateral border in the Dinornis. The outer surface of the sternum in the Dinornis shows the impressions of the decussating bands and fibres of the aponeurotic periosteum, with which it was covered when recent.

A part of a young Apteryx, which I owe to Dr. Robert Hunter, demonstrates that the sternum is developed, as in other *Struthionidæ*, from two lateral centres, whence the ossification radiates, and converging to the middle line, there produces confluence of the primitively separate halves. We cannot doubt, from the close conformity of the sternum of the adult Dinornis with that of the Apteryx, that it was developed in the same way, and not, as in the *Gallinacea*, from more numerous separate centres, notwithstanding the rasorial proportions of the metatarsus.

Bones of the Extremities.

Although the title of a former Memoir* referred to five species of *Dinornis*, determined from the osseous remains transmitted by Archdeacon Williams from the North Island of New Zealand, a sixth species was indicated in the Memoir itself, under the name of *dromioides*, by the characters of a femur†, the only bone of the extremities referable to that species which I at that time possessed.

I have since received from the North Island, by the kindness of Mr. Cotton, two other femora, agreeing in size and characters with the one referred to the *Dinornis dromioides*, together with two tibiæ and a metatarsal bone, of a size in respect of breadth of extremities and circumference of shaft suited to those femora, and differing from the homologous bones in all other known species of *Dinornis* by being more slender in proportion to their length and longer in relation to the femur; thereby approaching more nearly to the proportions of the leg-bones in the Emeu and other large existing *Struthionidæ*, and confirming my conjecture founded upon the characteristic proportions of the femur itself‡.

The species which I have called *Dinornis ingens* was founded principally on the characters of a femur and tibia. I have since received a tarso-metatarsal bone from the North Island, through the kindness of Mr. Colenso, and from the Middle Island there have been transmitted femora, tibiæ and tarso-metatarsals of apparently a more robust variety of *Dinornis ingens*, together establishing most satisfactorily the former existence of at least one species of *Dinornis* of the stature of nine feet.

The richest accessions to the osteology of this extraordinary genus of wingless birds have been made by Mr. Percy Earl, an enterprising naturalist, to whose exertions zoology is indebted for the recovery of the most perfect remains from the soil of New Zealand. These were discovered by Mr. Earl in a turbary deposit on the sea-coast of the Middle Island, near the settlement of Waikawaite. The deposit is overflowed by the sea at high-tides, and had been covered by a bed of sand and shingle; but this bed

* Zoological Transactions, vol. iii. part 3, 1844, p. 235.

† "The femur of nine inches in length, with similar proportions of the tibia and metatarsus, which latter would probably be relatively longer"—(the comparison is with *Dinornis didiformis*)—"gives the height of five feet to the species, which from its similarity of size to the Emeu I have called *Dinornis dromioides*."—*Ib.* p. 264, pl. 22.

‡ *Ib.* p. 252.

having been swept away by storm-waves a short time before Mr. Earl's arrival, the black bed of peat was exposed, to which Mr. Earl's attention was attracted by observing some bones projecting from its surface. These and many other bones, obtained by digging close to the surface, or at a moderate depth in the peat, all belonged to species of *Dinornis*.

Commencing with the leg-bones referable to known species, I first select for description the femur of the *Din. giganteus*, of which hitherto only the shaft has been described; but I have now had the opportunity of examining four perfect specimens contained in the collections of Dr. Mackellar and Mr. Percy Earl.

The femur of the gigantic *Dinornis* closely accords with the generic characters of the bone, as given in the former memoir (pp. 247, 248). The rough surface for implantation of a muscle at the middle of the fore-part of the proximal end is well-marked, and there is an obtuse prominence from the middle of the rotular concavity (Pl. XLIV. fig. 2, *r*) above the transverse ridge which divides this from the lower inter-condyloid space. The back-part of the proximal extremity of the bone is entire and imperforate, as in the other species of *Dinornis*. Its dimensions are given in the 'Table of Admeasurements': the length precisely accords with that conjecturally assigned to the femur of the Gigantic species in the former memoir (p. 248, table, f. 1 and Note[a]).

The circumference of the middle of the shaft exceeds that of the fragment there described, and indicates the Gigantic Dinornis of the Middle Island to have been a stronger and more robust bird than that represented by the bones from the North Island, described in the former memoir. In Plate XLIV. the proximal (fig. 1) and distal (fig. 2) extremities of this noble bone are figured of the natural size.

Fine tibiæ of *Din. giganteus* in both Dr. Mackellar's and Mr. Percy Earl's collections supplied, by the perfect state of their articular ends, what was defective in the more ancient and rolled bones from the North Island. The head of the tibia is characterized in Birds by the flat or sinuous, or sometimes slightly convex articular surface (Pl. XLV. *a*, *a*) adapted to the inner condyle of the femur, by the large size of the tuberosity (*ib. t*) which divides this from the smaller sloping articular surface applied to the inner side of the outer condyle, and by the 'epicnemial' ridge (*b*), which is commonly broad and more or less produced upwards from the anterior and outer part of the proximal surface of the tibia. From the outer, usually more or less obtuse, angle of the epicnemial ridge a short 'ectocnemial' ridge (*k*) is commonly continued downwards upon the outer part of the shaft: a compressed prominent 'procnemial*' ridge (*p*) is continued further down the fore-part of the shaft of the tibia.

The proximal end of the tibia of the Gigantic Dinornis (Pl. XLV. fig. 1) agrees, like that

* To facilitate and make more intelligible the comparisons of the tibiæ in the different species of Dinornis and other birds, I have proposed the above names for the well-marked and constant processes and ridges which have not before received any distinct appellations in Comparative Anatomy.

in the smaller species, with the modifications of the ornithic type presented by most *Grallæ* and *Gallinæ* (*ib.* fig. 4, *Ciconia argala*), but differs considerably from the corresponding part in the Ostrich (*ib.* fig. 2). In this largest of existing *Struthionidæ* the epicnemial process (*b*) does not rise above the level of the proximal surface of the tibia, but extends directly forwards, sends out a compressed and prominent procnemial ridge (*p*) and a short thick obtuse process (*k*) from its outer side in place of the ectocnemial ridge. In the Dinornis the posterior articular tuberosity (fig. 1, *t*) is divided by a wider and deeper depression than in the Ostrich, from a smaller anterior prominence to which a fibular ligament is attached (fig. 4, *l*) : this depression in the Dinornis receives the inner prominent division of the outer condyle of the femur ; the posterior tibial tuberosity rising into the space between that and the inner condyle, whilst the fore-part of the outer condyle rests upon the inner side of the ascending tibial ridge : this occasions a closer interlocking of the tibia and femur than in the Ostrich. The only difference in the dimensions of the tibiæ of the *Dinornis giganteus* from the North and Middle Islands is a slight increase of the breadth of the distal end of the more recent and better-preserved bones from the latter locality (see the 'Table of Admeasurements'). I subjoin to the figure of the well-preserved proximal end of one of these tibiæ from the Middle Island, figures of the same parts of the tibia in the Ostrich (fig. 2), Emeu (fig. 3), and Gigantic Crane (fig. 4), all of the natural size.

The tarso-metatarsal bones of the *Dinornis giganteus* from the Middle Island are more generally and sensibly stronger in proportion to their length than the femora or tibiæ, compared with those from the North Island ; but I cannot venture to infer from this evidence alone more than a stronger variety of the species : the degree of difference is accurately given in the 'Table of Admeasurements.'

A new species might with more reason be founded on the bones of the hind extremity from the Middle Island, which agree in length with those of the *Dinornis ingens*, since they surpass in thickness in a somewhat greater degree their homologues from the North Island. This difference I have not only been able to appreciate with regard to the femur and tibia on which the species *D. ingens* was founded*, but also with regard to the tarso-metatarsal bones, having received one specimen from the North Island, transmitted by Mr. Colenso, which presents intermediate dimensions between the tarso-metatarsal bones referred to *Dinornis giganteus* and *Dinornis struthoides*, and having compared it with three tarso-metatarsals of similar length in the collection of Mr. Percy Earl. These differences will be appreciated by the 'Table of Comparative Dimensions'; but I shall here notice these stronger bones from the Middle Island as belonging to *Dinornis ingens*, var. *robustus*, until other parts of the skeleton, especially the skull, may arrive, although the following differences of form are observable in the homologous bones of the extremities from the two localities.

* *Loc. cit.* pp. 247, 250.

In the femur of the robust variety of *Dinornis ingens* from the Middle Island, the upper tuberosity of the two posterior ones is nearer the lower than the upper end of the bone; in the femur of the *Din. ingens* from the North Island it is nearer the middle of the shaft. In the *Din. ingens* from the Middle Island the inner contour of the femur descending from the head is less concave: the outer expanded surface of the proximal end of the bone forms an obtuse angle with the posterior surface, not a right angle, as in the *Din. ingens* from the North Island. In the *Din. ingens* from the Middle Island the great trochanterian ridge extends more boldly out, its contour is more convex, and it is relatively larger. The same may be observed with regard to the antero-external prominence of the outer condyle: the length of shaft included between the lower end of the trochanterian prominence and the upper end of the external condyloid prominence is four inches nine lines in the robust variety, and five inches five lines in the femur from the North Island.

The proportions of the tarso-metatarsal bone of the *Dinornis ingens*, as exemplified in the bone (Pl. XLVIII. fig. 1) sent by Mr. Colenso from the North Island, are nearly those of the *Din. struthoides*. In the tarso-metatarsal bone of *Din. giganteus* the antero-posterior thickness of the shaft is greater. The anterior surface of the upper half of the shaft, below the perforated depression, shows a slight longitudinal concavity in *Din. ingens*. Towards the inner side of the posterior part of the lower half of the shaft there is a rough tract of three inches in length, and at its lower end a rough oval depression (*ib. d*), about one inch by nine lines. The surface in the tarso-metatarsal bone of the Apteryx for the attachment of the back-toe occupies the corresponding place: the *Dinornis ingens* therefore, by this mark of resemblance to the Apteryx, may belong to a genus (*Palapteryx*) distinct from *Dinornis*. The accuracy of the reference of the tarso-metatarsal bone, *m* 2, in the former Memoir (p. 244) to a young individual of the *Dinornis giganteus*, is well-illustrated by the present bone, in which the shaft, from the perforated proximal anterior depression to the beginning of the clefts of the distal articular trochleæ, is precisely the same as in *m* 2; the tarso-metatarsal in the *Dinornis ingens* manifesting all the characters of age, by complete confluence of its primitively distinct elements, as well as by the strong and rough lateral ridges for ligamentous and aponeurotic attachments; whilst *m* 2, with the same length of shaft, shows, as described in the former Memoir, the still open fissures between the proximal ends of the three constituent metatarsals.

The species, which I have called *Dinornis casuarinus*, is most satisfactorily determined by ten femora, five of the left and five of the right leg; by eleven tibiæ, five of the left and six of the right leg; and by six tarso-metatarsal bones, most of which bones have been obtained from the Middle Island, at the locality and turbary deposit near Waikawaite.

I had already figured one of the bones of this species from the North Island in my former Memoir, viz. a mutilated femur (Plate XXIII. fig. 1), which I then regarded as belonging to a young individual of the *Dinornis struthoides*. The acquisition of so many entire femora, tibiæ and tarso-metatarsal bones, evidently belonging, by their proportional size and exact co-adaptation of articular surfaces, to the same species of bird, has enabled me to detect specific characters in the femur and tibia, by which this species, for which I propose the name of *Dinornis casuarinus*, clearly differs from both *Dinornis struthoides* and *Dinornis didiformis*. But I may be permitted to observe, that the reference of the solitary mutilated femur to the young of the *Din. struthoides*, which I am now enabled to correct, was a mistake on the safe side: the caution which refrains from multiplying specific names on incomplete evidence is less hurtful to the true progress of zoological science than the opposite extreme.

The specific characters of *Din. casuarinus* and its distinction from *Din. dromioides*, with which it most nearly agrees in size, and especially in length, will be most prominently brought out by combining the descriptions of the bones of both species.

The femur of the *Din. casuarinus* very little exceeds that of the *Din. dromioides* in length, but rather more in the circumference of the shaft, and very considerably in the development of the two extremities. The head is relatively larger, as Pl. XXIII. of my former Memoir shows: the tuberosities below the middle of the back-part of the shaft are more developed: the rotular interspace between the condyles is both wider and deeper: the posterior half of the internal condyle is relatively much larger. But both the internal and the external longitudinal narrow ridges are more marked in *Din. dromioides* than in *Din. casuarinus*.

The well-marked differences between the femora of these nearly similarly-sized species will be readily appreciated by comparing Pl. XLVI. with Pl. XXII. of Vol. iii. The specimen figured is rather less than other femora of the same species from the same locality.

The most obvious distinction between the tibiæ of the *Din. dromioides* and *Din. casuarinus*, in the relation of their thickness to their length, is shown in the 'Table of Admeasurements' and in Plate XLVII. figg. 1 & 2. The tibia of the *Din. dromioides* (fig. 1) is longer and more slender, corresponding with the character of the femur: the interspace between the ectocnemial tuberosity (*k*) and the procnemial crista (*p*) at the proximal end is less than in *Din. casuarinus*, and the procnemial ridge continued down from the crista does not so soon gain the middle of the anterior surface of the shaft, and is continued down the middle to the lower third before it inclines to the inner side: the tendinous groove leading to the osseous bridge (*f*) in front of the distal end is shorter and deeper. The orifice of the canal for the medullary artery is at the same distance from the top in the tibiæ of both species. The antero-posterior thickness of the shaft of the tibia at its proximal third is markedly less in *Din. dromioides* than in *Din. casuarinus*. The difference in the plane and aspect of the surface between the anterior and fibular ridge in the *Din. dromioides* and *Din. casuarinus* is well-marked.

The proportions of the tarso-metatarsus of *Din. dromioides* (Pl. XLVIII. fig. 2) are, as those of the femur led me to conjecture*, more slender, and the bone is relatively

* "The femur *f* 16 cannot be regarded as belonging to a young individual of the gigantic species; there

longer, not only than in *Din. didiformis*, but also than in any other known species of *Dinornis*, not excepting the *Din. ingens*, to the tarso-metatarsal bone of which the present tarso-metatarsal from the North Island bears the nearest resemblance in general form and proportions, and in the important character of the rough oval surface (*ib. d*) indicative of the attachment of a back-toe, one-fourth from the distal end. Little needs to be added to the 'Comparative Table of Admeasurements,' and to the figures in Plate XLVIII., for the exposition of the specific characters of this bone. In the form of the concavity at the middle of the fore-part of the upper half of the shaft it resembles the tarso-metatarsus of the *Din. struthoides* more than that of the *Din. casuarinus*, in which, as in *Din. crassus*, the same surface below the rough and perforated depression is flat or slightly convex.

The tarso-metatarsal bone of the *Din. casuarinus* (Pl. XLVIII. fig. 3) is remarkable, not only for its great breadth, in proportion to its length, but also, like the femur, for the expansion of the distal end, and especially the production of the inner trochlear division.

I was much gratified, on inspecting Mr. Percy Earl's large collection of remains of Dinornis from Waikawaite, to find with how little difficulty the bones could be selected which belonged to the species which had been named:—

Dinornis giganteus,
——— *ingens*,
——— *struthoides*,
——— *dromioides*.

Of the second of these species, of which I had before seen only the femur and tibia from the North Island, Mr. Earl's collection contained the tarso-metatarsal bones, besides very perfect specimens of femora and tibiæ.

Thus it appears that four species of *Dinornis*, including the three most remarkable for their gigantic stature, were common to both the North and South Islands.

Mr. Earl's collection did not contain any specimen of *Dinornis didiformis* or of *Din. otidiformis*; but after selecting those bones which agreed with the previously determined species, there remained a considerable number of most perfect specimens of femora, tibiæ and tarso-metatarsal bones of unquestionably full-grown individuals, which differed as much in configuration and proportions from the previously determined species as these did from one another. The most abundant remains belonged to the species above defined under the name of *Din. casuarinus*; but the most extraordinary species is that

remains then no other conclusion than that it must represent a fifth distinct species, of which there are neither tibiæ nor metatarsi in the present collection. I venture to surmise, that the tibia, and especially the tarso-metatarsus of this species, will be found relatively longer and more slender than in the *Din. struthoides* and *Din. didiformis*: so much may be anticipated from the more slender proportions of the femur, which moreover resembles the femur of the Emeu in some of the characters by which it differs from the above species of *Dinornis*."—*Loc. cit.* p. 252.

which I propose to call *Dinornis crassus*. It is intermediate in size between *Din. ingens* and *Din. struthoides*: with a stature nearly equal in height to that of the Ostrich, the femur and tarso-metatarsus (Pl. XLVIII. figg. 4 & 5) present double the thickness in proportion to their length: it must have been the strongest and most robust of Birds, and may be said to have represented the pachydermal type and proportions in the feathered class.

The species described under the name of *Din. casuarinus* combined the stature of the Cassowary with more robust proportions, and especially more gallinaceous character of the feet. The third new species is intermediate in size between the *Din. didiformis* and *Din. otidiformis*, and I propose to name it *Dinornis curtus*. Although the majority of the remains of *Din. casuarinus* have come from the Middle Island, a few specimens have reached me from the North Island. Remains of *Dinornis crassus* have hitherto been found only in the Middle Island, and those of *Dinornis curtus* are at present as exclusively from the North Island.

Of the *Dinornis curtus* I have received from Mr. Cotton the shaft of a femur, a little more complete than that of the *Dinornis otidiformis*, and apparently shorter in proportion to its circumference, but having the same relative superiority of general size, and especially thickness, which is manifested in the tibia and tarso-metatarse of the *Din. curtus*.

The tibia of *Dinornis curtus* (Pl. XLVII. figg. 3, 4 & 5) resembles that of *Dinornis casuarinus* in the extent and form of the ectocnemial process (*k*); in the distance between this and the procnemial crista (*p*), and in the position and course of the ridge continued thence down the fore-part of the shaft to the inner pier of the distal osseous bridge (*f*). It differs from *Din. casuarinus* and the other larger species of the genus in the lower position of the nutri-arterial foramen, which is nearly half-way between the two ends of the bone. The distal condyles resemble those of the tibiæ of the larger species much more than those of the smaller *Din. otidiformis*. The inner side of the shaft is more rounded, less angular than in *Dinornis didiformis* or *Din. casuarinus*, and the anterior surface slopes more abruptly backwards to the fibular ridge; the surface between the anterior ridge and fibular ridge being convex in *Din. curtus*, but almost plane in *Din. casuarinus*. The outer (fibular) division (*o*) of the distal condyle is less produced forwards than in *Din. didiformis*, but in this respect resembles that in *Din. casuarinus*; its transverse extent is however relatively greater. The tibia, and consequently the whole leg of *Din. curtus*, is shorter in proportion to the femur and the tarso-metatarsus than in the *Din. didiformis* or any other species, except probably the *Din. crassus*, of which only the femur and tarso-metatarsus have yet been obtained.

That *Dinornis curtus* is not the young of *Din. didiformis*, is proved by its tarso-metatarsal bone (Pl. XLVIII. fig. 6). The tarso-metatarsal bone *m* 2, p. 244, *mem. cit.*, proves that the homologous bone of a young *Din. didiformis*, of the size of that of *Din. curtus*, (see 'Table of Dimensions,') wanting therefore one-fourth of its full size, would exhibit the same imperfect coalescence of the proximal ends of the primitively distinct metatarsals which characterizes the above-cited tarso-metatarsal of the young *Din. giganteus*. In the tarso-metatarsal bone of the *Din. curtus*, figured in Pl. XLVIII. fig. 6, the coalescence is as complete as in the corresponding mature bones of all the larger species of *Dinornis*. Besides, it differs from the tarso-metatarsal bone of the *Din. didiformis* not in size only, but in shape and proportions, the shaft being broader in proportion to the length of the bone.

The information derived from the specimens of *Dinornis* transmitted to this country since the publication of Part 3. Vol. iii. of the 'Transactions of the Zoological Society,' may be summed up as follows:—

Confirmation of the deductions as to the rudimental development of the wings in the genus *Dinornis*, by the discovery of the keel-less sternum, and the evidence it affords of the small size of the coracoid bones.

Confirmation that the species of this essentially terrestrial genus were heavier and more bulky birds in proportion to their height, more powerful scratchers, and less swift of foot than the Ostrich*, but in different degrees, according to the species.

Indications of an affinity to the Dodo in the shape of the cranium; but with evidence of a lower development of the *cerebrum*, whence the Dinornis may be inferred to have been a duller and more stupid bird.

Confirmation of the species—

1. *Dinornis giganteus.*
2. ——— *ingens*
3. ——— *struthoides.*
4. ——— *dromioides.*
5. ——— *didiformis.*
6. ——— *otidiformis.*

* A correspondent of the 'Polytechnic Journal' for July 1843, commenting on my description of the fragment of the femur of the Movie, in the 'Proceedings of the Zoological Society,' November 1839, objects: "Neither does its femur furnish reason to conjecture that it was swift or slow of foot." (p. 7.) I have not however drawn any absolute conclusion as to the rate of locomotion of the Dinornis. My remark was merely comparative, as respected the Ostrich. In this large existing bird, which is remarkable for both its swift and long-sustained course, the femur is filled with air, like that of a bird of flight. In the fragment of femur which first indicated the genus *Dinornis*, I found the cavity of the bone much smaller than in the Ostrich, with evidence that it had contained marrow; the bony walls being thicker, the cancellous structure more extensive, and the whole bone heavier than in the Ostrich. The femur of the Dinornis therefore did furnish not merely 'reason for conjecture,' but grounds for legitimate physiological conclusion, that that extinct bird was heavier and less swift-footed than the Ostrich.

The proportions of the other bones of the leg which have since arrived establish the accuracy of the conclusion deduced from the structure of the femur; the metatarsal bones being in the Dinornis one-third shorter and thicker in proportion than in the Ostrich, thus rendering the legs more like those of the Apteryx, and consequently more like those of the Gallinaceous birds than in any of the existing large Struthious tribe.

Indications that *Dinornis ingens* and *Din. dromioides* belong to a distinct genus, characterized by a back-toe, for which the name of *Palapteryx* is proposed.

Establishment of the additional species—

7. *Dinornis crassus.*
8. ——— *casuarinus.*
9. ——— *curtus.*

Evidence of well-marked varieties of *Dinornis gigas* and *Din. ingens*, those of the Middle Island presenting more robust proportions than those of the North Island of New Zealand.

The three smaller species, *Din. didiformis*, *Din. curtus* and *Din. otidiformis*, have hitherto been found only in the North Island; the *Din. crassus* seems to have been peculiar to the Middle Island; the other species are common to both Islands; but it would be premature to enunciate any absolute propositions respecting the relations of species to the two chief divisions of New Zealand in the present early period of the inquiry into its extinct Fauna, whilst the evidences appear to exist in such vast abundance and are likelv so richly to reward the zeal of future collectors*.

* The Rev. Mr. Taylor has favoured me, through Capt. Sir Everard Home, Bart., R.N., with the following note respecting the Dinornis and Apteryx of New Zealand:—

"Whanganui, February 14th, 1844.

"During a journey to Turakina last summer, I was led to the discovery of a large number of the Moa's bones, by accidentally observing a small fragment of a large bone, which, from its extremely cellular structure, led me at once to think it might belong to the Moa. I made the inquiry of a native, who not only confirmed my conjecture, but in reply to the further inquiry, whether such bones were frequently found, told me to look around, and see whether I could not perceive any others. Upon turning a little aside from the path, I noticed several little hillocks formed of bones scattered over the valley; I hastened to them, and so numerous were they that a few minutes sufficed to fill my food-box with choice specimens, emptying out my provision for that purpose, much to the astonishment of the natives, who could not imagine what was my object in loading them with these dry bones: at last they concluded it must be for medicine.

"I found these bones at the mouth of the Whaingaihu, where the sand had drifted over the valley, and I have no doubt there are still many similar heaps covered up by it; each heap was composed of the bones of several kinds of the Moa, as though their bodies had been eaten, and the bones of all thrown indiscriminately together; but such was the friable state they were in, that it was only the larger ones which would bear removal; the bones of the smaller kinds pulverized in the hand, and upon searching below the surface I found the whole one jumbled mass of decomposed bone: the subsoil was a loamy marl, beneath which was a stratum of clay, which chiefly forms the cliffs of this part of the western coast; it contains numerous marine shells, and very closely resembles the gault formation of the east coast of England. I have no doubt it was when that loamy marl was the surface-soil that the Moa lived: although by the river-side it is laid bare, in other parts it is covered by several strata of marine and freshwater deposit. I have found the bones of the Moa in this stratum not only in other parts of the western, but also on the eastern coast at the East Cape and at Poverty Bay, from whence in 1839 I procured a toe of this bird; but I have not heard of its being found north of Turakina.

"I have met with the remains of at least four varieties of the Apteryx family, of which it is highly probable three kinds are still in existence; the Kiwi, which is the smallest, being rather larger than the domestic cock, the male bird having a claw at the termination of its embryo wings; the Kakapo or Tarepo, which is about

No remnant of a *Dinornis* has yet been found in any of the contiguous islands, and I have in vain searched for such in the recent collections of post-pliocene fossils from Australia.

The extraordinary number of Wingless Birds, and the vast stature of some of the species, peculiar to New Zealand, and which have finally become extinct in that small tract of dry land, suggest it to be the remnant of a larger tract or continent over which this singular Struthious Fauna formerly ranged. One might almost be disposed to regard New Zealand as one end of a mighty wave of the unstable and ever-shifting crust of the earth, of which the opposite end, after having been long submerged, has again risen with its accumulated deposits in North America, showing us in the Connecticut sandstones of the Permian period the foot-prints of the gigantic birds which trod its surface before it sank; and to surmise that the intermediate body of the land-wave, along which the *Dinornis* may have travelled to New Zealand, has progressively subsided, and now lies beneath the Pacific Ocean.

the size of a turkey, and from its habits, nature and other circumstances seems so closely to resemble the Dodo, as to lead me to suppose it is the same; and lastly, a bird found in the southern parts of the Middle Island, answering to the Emeu, although perhaps not so high. The gigantic Moa, whose bones are fully as large, though not so ponderous, as those of the Elephant, is extinct, although everywhere traditions of its existence are to be met with, coupled with that of an equally enormous Land-Lizard: this large bird, though perhaps twelve or fifteen feet high, was not tall in proportion to its size. Although the articulations of the bones are many sizes larger than those of the Emeu, I have not yet met with a tibia longer than that of the Emeu of New South Wales."

Capt. Sir Everard Home adds, "I feel little doubt that the Dinornis exists in the Middle Island of New Zealand, which is very thinly inhabited and almost quite unknown; perhaps also in Stewart's Island, where it is said that the Cassowary (Moa?) is to be found."

"H.M.S. North Star, Sydney, April 13th, 1844."

TABLE OF ADMEASUREMENTS OF THE BONES OF THE LEG.

Dimensions of the Femora.

	Din. giganteus.	Din. ingens.		Din. crassus.	Din. struthoides.		Din. casuarinus.		Din. dromioides.			Din. didiformis.			Din. curtus.	Din. otidiformis.
		v. robustus.	*f* 2.		*f* 12.	*f Colenso.*	*f* 13.	*f* E.	*f* 6.	*f* 16.	*f Taylor.*	*f* 8.	*f* 7.	*f* 17.		*f* 10.
	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.
Length	16 0	13 9	13 0	12 0	11 0*	12 0	9 6†	10 4	9 4‡	9 6	9 7	8 0	8 0	8 1	0 0	0 0
Breadth of proximal end (in the axis of the neck)	6 6	5 5	4 10	5 0	4 2	4 2	3 5†	3 11	3 6	3 6	3 6	2 10	3 0	3 3	0 0	0 0
Breadth (transverse) of distal end	6 3	5 10	5 2	5 3	4 3	4 4	3 9	4 4	3 7	3 7	3 8	3 3	3 2	3 6	0 0	0 0
Circumference of middle	7 9	7 1	6 1	6 8	5 6	5 6	5 0	4 9	4 1	4 0	3 10½	4 0	4 0	4 3	2 9	2 1

* Perhaps not quite enough allowed for mutilated extremities. † Ib. ‡ Ib.

Dimensions of the Tibiæ.

	Din. giganteus.		Din. ingens.		Din. crassus.	Din. struthoides.		Din. casuarinus.	Din. dromioides.	Din. didiformis.			Din. curtus.	Din. otidiformis.
	t 1.	*t* E.	*t* 2.	*t* E 1.						*t* 3.	*t* 8.	*t* 9.		*t* 11.
	in. lin.	in. lin.	in. lin.	in. lin.		in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.
Length	35 0	35 0	29 0	28 9	......	......	......	19 0	21 0	15 6	15 4	15 4	11 3	8 9
Breadth of proximal end	7 6	7 0	6 2	6 6	......	5 6	5 4	5 6	4 8	4 5	0 0	0 0	3 3	2 0
Breadth of distal end	4 0	4 8	3 7	4 0	......	......	......	2 11	2 8	2 4	0 0	0 0	2 0	1 3
Circumference of middle	6 6	6 6	5 3	6 3	......	5 0	4 8	4 9	4 0	4 0	0 0	0 0	2 9	1 11
Fibular ridge extends down	13 0	13 0	12 0	12 0	......	10 0	10 0	8 6	9 0	6 10	0 0	0 0	4 9	3 6

Dimensions of the Tarso-metatarsals.

	Din. giganteus.		Din. ingens.		Din. crassus.	Din. struthoides.		Din. casuarinus.	Din. dromioides.	Din. didiformis.		Din. curtus.	Din. otidiformis.
	m 1.	*m* E.	*m* E. *v. robustus.*	*Colenso.*		*m* 3.	*m* E.						
	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	
Length	18 6	18 0	14 6	13 9	8 6	12 0	11 6	8 0	10 5	7 0	6 10	5 0	
Circumference at the middle of the shaft	5 6	6 0	5 6	4 6	4 8	4 3	4 2	4 2	3 9	3 3	3 3	2 10	
Breadth (transverse) of distal end	5 1*	6 0	5 6	4 6	4 0	4 0‡	4 5	3 10	3 4	......	3 0	2 5	
Breadth of middle of shaft	1 11	2 2	1 10	1 7	1 10	1 6	1 6	1 7	1 4	1 5	1 3	1 1	
Thickness or antero-posterior diameter of ditto	1 6	1 6	1 5	1 3	1 2	1 1	1 1	0 10	0 10	0 9	0 9	0 7	
Breadth (transverse) of proximal end	0 0	4 6	4 3†	3 6	3 3½	......	3 5	3 0	2 10	......	2 3	1 11	

* The margins being broken and water-worn, I had not allowed sufficient for the entire bone. † With a ridge at the middle of inner condyle at proximal end. ‡ Perhaps not enough allowed for water-worn margins of trochleæ.

Average Dimensions of Bones of *Dinornis* in comparison with those of existing *Struthionidæ*.

	Din. giganteus.	Din. ingens.	Ostrich.	Din. crassus.	Din. struthoides.	Emeu.	Din. casuarinus.	Din. dromioides.	Din. didiformis.	Din. curtus.	Din. otidiformis.	Apteryx.
	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.
Length of femur	16 0	13 6	11 0	12 0	11 0	9 0	10 2	9 6	8 0	0 0	0 0	3 9
Circumference of ditto	7 3	6 10	5 3	6 8	4 2	3 7	4 9	4 0	4 0	2 9	2 1	1 0
Length of tibia	35 0	28 10	18 6	......	25 0	16 10	19 0	21 0	16 3	11 3	8 9	5 3
Circumference of ditto	6 6	6 0	4 3	......	5 0	3 4	4 9	4 0	4 1	2 9	1 11	1 3
Length of metatarsus	18 6	14 0	16 0	8 6	12 0	15 0	8 0	10 5	7 0	5 0	......	3 3
Circumference of ditto	5 6	5 0	3 7	4 8	4 3	3 0	4 2	3 9	3 6	2 10	......	1 0

XIV. *Observations on the Dodo* (Didus ineptus, *Linn.*)*; an Appendix to the foregoing Memoir on the* Dinornis. *By* Professor Owen, *F.R.S., Z.S. &c.*

Read July 14, 1846.

THE interest in the history of the brevipennate terrestrial Birds, which the special investigation of the remains of those of New Zealand has excited, induces me to subjoin a few observations which I made during a recent visit to Oxford, on the famous head and foot of the Dodo preserved in the Ashmolean Museum of that University.

The Dodo's skull differs from that of any species of *Vulturidæ*, or any Raptorial Bird, in the greater elevation of the frontal bones above the cerebral hemispheres, and in the sudden sinking of the inter-orbital and nasal region of the forehead; in the rapid compression of the beak anterior to the orbits; in the elongation of the compressed mandibles, and in the depth and direction of the sloping symphysis of the lower jaw.

The eyes of the Dodo are very small compared with those of the *Vulturidæ* or other *Raptores*. The external ears are narrow vertical subelliptic apertures, situated between the mastoid prominences and the angular processes of the lower jaw: each aperture is ten lines long and four lines wide. All traces of the auricular circle of feathers is lost. The nostrils (Pl. XXXVIII. fig. 5, *n*), it is true, pierce the cere, but are more advanced in position; this however seems essentially to depend upon the excessive elongation of the basal part of the upper mandible before the commencement of the uncinated extremity: the nostrils are pierced near the commencement of this uncinated part as in the *Vulturidæ*, but are nearer the lower border of the mandible in the Dodo.

The resemblance between the skull of the Dodo and that of the Albatros is chiefly in the compression and prolongation of the curved mandibles; there are no traces in the Dodo of the hexagonal space which marks the upper surface of the cranium of the Albatros, so well-defined there by the two supra-occipital ridges behind, the two temporal ridges at the sides, and the two converging posterior boundaries of the supraorbital glandular fossæ in front. There is no sudden depression of the frontal region in the skull of the Albatros: the nostrils are near the upper surface of the basal third of the beak in the Albatros, and the Dodo's cranium is thrice as broad in proportion to the breadth of the mid-part of the mandible as in that of the Albatros.

More satisfactory evidence of the affinities of the Dodo may be obtained from a comparison of the bones of the foot, which have recently been very skilfully and judiciously exposed by Dr. Kidd, the learned and accomplished Regius Professor of Physic, Oxford, and formerly Reader in Anatomy in the same University.

The tarso-metatarsal bone (Pl. XLIX. & L. fig. 1, *m m*) most resembles in its thickness and general proportions that of the Eagles, especially the great Sea-Eagles (*Haliaëtus*, *ib.* fig. 2) ; it is much stronger than the tarso-metatarsus of any of the *Vulturidæ*, or than that of the Cock, the *Crax*, or any of the *Gallinæ* or existing *Struthionidæ* ; the stronger-footed species of *Dinornis* most resemble it in the general proportions of the tarso-metatarsus, but greatly differ in the particular configuration of the bone, and in the absence or feebler indication (as in *Palapteryx*) of the articulation for the metatarsal bone of the back-toe. The relative size of this bone (*ib. pm*) is greater in the Dodo than in any other known bird. The Eagles make the nearest approach to it in this respect, as also in the shape of the back metatarsal (*ib.* fig. 2. *pm*), the breadth of its distal end, and its peculiar twist backwards and outwards, so as to form a bridge or pulley against which the flexor tendon of the hind-toe plays.

This half-twist of the rudimental back metatarsal is feebly repeated in the *Gallinæ* ; but the bone is much less expanded at its lower articular end, especially in the *Crax* ; whilst the more typical *Gallinæ* are further distinguished from the Dodo by their spur.

The Apteryx is the sole existing Struthioid bird which possesses the hind-toe ; but it is very much smaller than in the Dodo, and the supporting metatarsal bone is devoid of the distal twist and expanded trochlea (*ib.* fig. 3, *pm*).

The upper end of the tarso-metatarsus of the Dodo is remarkable for the great development of its calcaneal process (*c*), from which a strong ridge descends, gradually subsiding half-way down the bone. The posterior surface of the calcaneal process is broad, triangular, vertically grooved, and perforated at its base. In the Eagle the corresponding calcaneal process is a compressed subquadrate ridge, whose base of attachment is not much longer than the obtuse end, and this is neither grooved nor perforated. In the *Cathartes Californianus* the calcaneal process is thicker than in the Eagle, shaped more like that of the Dodo, with a ridge descending upon the metatarsus ; but it has a double groove behind.

In the common Cock the calcaneal process more resembles that in the Dodo than the Vulture's does, but it is not so broad.

With regard to the first or proximal phalanx of the hind-toe, that of the *Haliaëtus* is larger and broader, especially at its base, stronger in proportion to its length, but longer in proportion to the sustaining metatarsus.

In the Vultures the proximal phalanx is not only longer in proportion to the metatarsus, but is more slender than in the Dodo. The same bone is also longer and more slender in proportion to the small supporting metatarsal bone in the Cock, the *Crax*, and all other *Gallinæ* ; in fact, the Dodo is peculiar among Birds for the equality of length of the metatarsus and proximal phalanx of the hind-toe. With regard to the three trochlear extremities of the principal coalesced metatarsals, the middle one in all *Gallinæ* is longer in proportion than in the Dodo, in which the inner one is nearly as long as the middle one, the outer one being the shortest. In the Eagle the inner division is of equal length with, or is longer than, the middle trochlea; the proportions of the three trochleæ in the Vultures corresponding best with those in the Dodo. Another character by which the Dodo resembles the Vulture more than the Eagle is manifested by the proportions of the proximal phalanx of the second toe (innermost of the three anterior ones); this is very short, and is often anchylosed to the second phalanx in the Eagles; it is almost as long in the Vultures as in the Dodo.

Upon the whole, then, the Raptorial character prevails most in the structure of the foot, as in the general form of the beak of the Dodo, and the present limited amount of our anatomical knowledge of the extinct terrestrial Bird of the Mauritius supports the conclusion that it is an extremely modified form of the Raptorial order *. Devoid of the power of flight, it could have had small chance of obtaining food by preying upon the members of its own class; and if it did not exclusively subsist on dead and decaying organized matter, it most probably restricted its attacks to the class of Reptiles and to the littoral fishes, crustacea, &c., which its well-developed back-toe and claw would enable it to seize and hold with a firm gripe.

If equally diligent search for bones of the Dodo were made in the superficial deposits, the alluvium of rivers and the caves, in the islands of Mauritius and Rodriguez, as has been prosecuted in New Zealand in regard to the extinct wingless birds of that island, there can be little doubt that such praiseworthy search would be as successful and as important in advancing our knowledge of the nature and affinities of the Dodo †.

DESCRIPTION OF THE PLATES.

PLATE XXXVIII.

Fig. 1. Back view of the cranium of *Dinornis struthoides.*
2. Side view of ditto.
3. Upper view of ditto.

* Prof. De Blainville has indicated this affinity of the Dodo in the 'Nouvelles Annales du Muséum,' 4to, t. iv. p. 27, 1835. See also Mr. Broderip's admirable article Dodo, in the 'Penny Cyclopædia,' which concludes with the following passage:—"The *Vulturidæ* are, as we know, amongst the most active agents for removing the rapidly decomposing animal remains in tropical climates, and they are provided with a prodigal development of wing to waft them speedily to the spot tainted by the corrupt incumbrance. But no such power of wing would be required by a bird appointed to clear away the decaying and decomposing masses of a luxuriant tropical vegetation—a kind of Vulture for vegetable impurities, so to speak,—and such an office would not be by any means inconsistent with comparative slowness of motion."

† Mr. Strickland's interesting communication to the Zoological Society ('Proceedings of Scientific Meeting,' April 23, 1844) justifies the expectation that remains of other extinct brevipennate terrestrial birds, besides the Dodo, would be met with in the islands of Rodriguez and Bourbon.

Fig. 4. Under view of ditto, mutilated.
- 1. Basi-occipital.
- 1'. Occipital condyle.
- 3. Supra-occipital plate.
  - *r*. Supra-occipital ridges.
  - *d*. Supra-occipital impressions.
- 4. Par-occipital process.
- 5. Carotid canal in basi-sphenoid.
- 6. Foramen ovale in ali-sphenoid.
  - *n*. Foramen rotundum.
  - *o*. Foramen opticum.
- 7. Parietal portion of cranium.
- 8. Mastoid process.
- 11. Frontal portion of cranium.
- 11'. Orbital plate of frontal.
- 12. Post-frontal prominence.
- 18. Æthmoidal cavities for organ of smell.
- 28. Articular depression for os tympanicum.

Fig. 5. Upper view of the dried head of the Dodo (*Didus ineptus*), preserved in the Ashmolean Museum at Oxford.
- *n*. Nostrils. (All the figures are of the natural size.)

PLATE XXXIX.

Fig. 1. Upper view of the skull of the Emeu (*Dromaius Novæ Hollandiæ*).
2. Under or base-view of ditto, wanting the lower jaw and right tympanic bone.
3. Side view of cranium of ditto.
4. Side view of cranium of *Dinornis dromioides*.
5. Upper view of ditto.
6. Under view of fore-part of cranium of ditto.
   - 1. Basi-occipital.
   - 2. Ex-occipitals.
   - 3. Supra-occipital.
   - 4. Par-occipital.
   - 5. Basi-sphenoid.
   - 6. Ali-sphenoid.
   - 7. Parietals.
   - 8. Mastoids.
   - 9. Pre-sphenoid.
   - 11. Frontals.

11'. Orbital plate of frontal.
12. Post-frontals.
13. Vomer.
14. Pre-frontal.
15. Nasals (in fig. 5 the figures indicate their articular notches in the frontal bone).
18. (Fig. 6) Æthmoidal cavities for organ of smell.
20. Palatines.
21. Maxillary.
22. Premaxillary.
23. Pterygoid.
26. Malar.
27. Zygomatic (homologue of squamo-temporal).
28. Tympanic.
73. Lachrymal.

Fig. 7. Portion of os tympanicum of *Dinornis giganteus.*
Fig. 8. Os tympanicum of *Struthio camelus.*
Fig. 9. Os tympanicum of *Apteryx australis.*
a. Anterior or orbital process.
b. External or zygomatic process.
c. Inferior or mandibular articular surface.

PLATE XL.

Fig. 1. Side view of an upper or anterior cervical vertebra of *Dinornis ingens.*
2. Front view of the same vertebra.
3. Upper view of the same vertebra.
4. Side view of an upper or anterior cervical vertebra of *Dinornis giganteus.*
5. Upper view of the same vertebra.
a. Anterior articular surface of the body.
n. Neural canal.
pl. Pleurapophysis, or anchylosed cervical rib.
s. Rudiment of spinous process.
v. Canal for vertebral artery.
z. Anterior zygapophysis, or oblique or articular process.
z'. Posterior zygapophysis.

PLATE XLI.

Fig. 1. Side view of an inferior cervical vertebra of *Dinornis giganteus.*
2. Front view of the same vertebra.

Fig. 3. Under view of the same vertebra.
- *a.* Anterior articular surface of body.
- *a'.* Its continuation upon the lower part of the body.
- *c.* Parapophysis, or lower transverse process, from the body of the vertebra.
- *d.* Diapophysis, or upper transverse process, from the neural arch.
- *e.* Anterior zygapophyses or articular processes.
- *f.* Posterior zygapophyses.
- *g.* Superior or neural spine.
- *h.* Inferior or hæmal spine.
- *i.* Pneumatic orifice.

Fig. 4. Side view of ungual phalanx or claw-bone of a large species of Dinornis.
Fig. 5. Upper view of the same phalanx.
6. Back view or articular surface of the same phalanx.

PLATE XLII.

Fig. 1. Side view of a dorsal vertebra of *Dinornis crassus*.
2. Front view of the same vertebra (*minus* the spine).
3. Front view of a dorsal vertebra of *Dinornis ingens*.
4. Under surface of the body of the same vertebra.
- *b.* Diapophysis.
- *c.* Costal articular surface.
- *f.* Foramen pneumaticum.
- *n.* Neural canal.
- *z.* Anterior zygapophyses.

PLATE XLIII.

Fig. 1. Mutilated sternum of *Dinornis giganteus*, half natural size.
2. Anterior border of the same sternum, natural size.
3. Lateral or costal border of the same sternum, natural size.
4. Reduced view of the anterior surface of the sternum of the Ostrich (*Struthio camelus*), Pander and D'Alton.
5. Ditto ditto *Rhea americana*.
6. Ditto ditto *Casuarinus indicus*.
7. Ditto ditto *Dromaius ater*.
8. Front view of the sternum of *Apteryx australis*, natural size.
- *a.* Anterior angles.
- *c.* Coracoid depressions.
- *m.* Anterior border.
- *e.* Posterior emarginations.

p. Posterior angular processes.
r. Costal articular surfaces.
x. Xiphoid prolongation or appendage.

PLATE XLIV.

Fig. 1. Proximal end of femur of *Dinornis giganteus*, natural size.
2. Distal end of the same femur, natural size.
r. Rotular surface.
f. Fibular surface.
t. Tibial surface.

PLATE XLV.

Fig. 1. Proximal end of tibia of *Dinornis giganteus*, natural size.
2. Ditto ditto *Struthio camelus*, ditto.
3. Ditto ditto *Dromaius Novæ Hollandiæ*, ditto.
4. Ditto ditto *Ciconia Argala*, ditto.
a. Inner condyloid surface.
t. Inter-condyloid tuberosity.
b. Epicnemial ridge.
p. Procnemial ridge.
k. Ectocnemial ridge.
l. Fibular ligament (fig. 4).
f. Head of fibula (fig. 4).

PLATE XLVI.

Fig. 1. Back view of femur of *Dinornis casuàrinus*, natural size.
2. Proximal end of same femur.
3. Distal end of same femur.
e. Ecto-condyloid fossa.
f. Fibular surface.
t. Tibial surface.
r. Rotular surface.

PLATE XLVII.

Fig. 1. Front view of tibia of *Dinornis dromioides*.
2. Ditto ditto *Dinornis casuarinus*.
3. Ditto ditto *Dinornis curtus*.

Fig. 4. Proximal end of the same tibia.
5. Side view of distal end of the same tibia.

(All the figures are of the natural size.)

a. Inner condyloid surface.
t. Inter-condyloid tuberosity.
b. Epicnemial ridge.
p. Procnemial ridge.
k. Ectocnemial ridge.
f. Trochlear bridge and foramen.

PLATE XLVIII.

Fig. 1. Back view of tarso-metatarsus of *Dinornis* (*Palapteryx*) *ingens*.
2. Ditto ditto *Dinornis* (*Palapteryx*) *dromioides*.
3. Ditto ditto *Dinornis casuarinus*.
4. Ditto ditto *Dinornis crassus*.
5. Distal extremity of the same bone.
6. Front view of mutilated tarso-metatarsus of *Dinornis curtus*.
d, figg. 1 & 2, rough surface for attachment of metatarsal bone of back-toe.

PLATE XLIX.

Fig. 1. Back view of the bones and tendons of the foot of *Didus ineptus*.
2. Back view of tarso-metatarsal bones of *Haliaëtus albicilla*.
3. Ditto ditto *Apteryx Australis*.

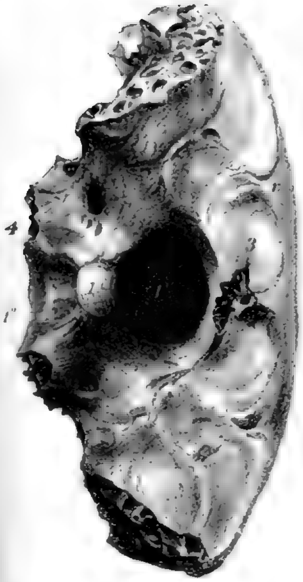
(All the figures are of the natural size.)

PLATE L.

Fig. 1. Side view of the bones and tendons of the foot of *Didus ineptus*.
2. Side view of tarso-metatarsal bones of *Haliaëtus albicilla*.
3. Ditto ditto *Apteryx Australis*.
m. Confluent tarsal and chief metatarsal bones.
c. Calcaneal process.
pm. Rudimental metatarsus of back-toe (I.).
1. Proximal phalanx.
2. Second phalanx.
3. Third phalanx (II. III. IV.).
4. Fourth phalanx (III. & IV.).
5. Fifth phalanx (IV.).

5

1



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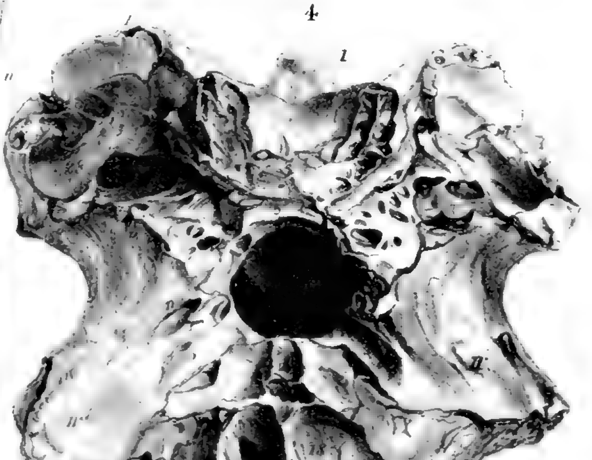
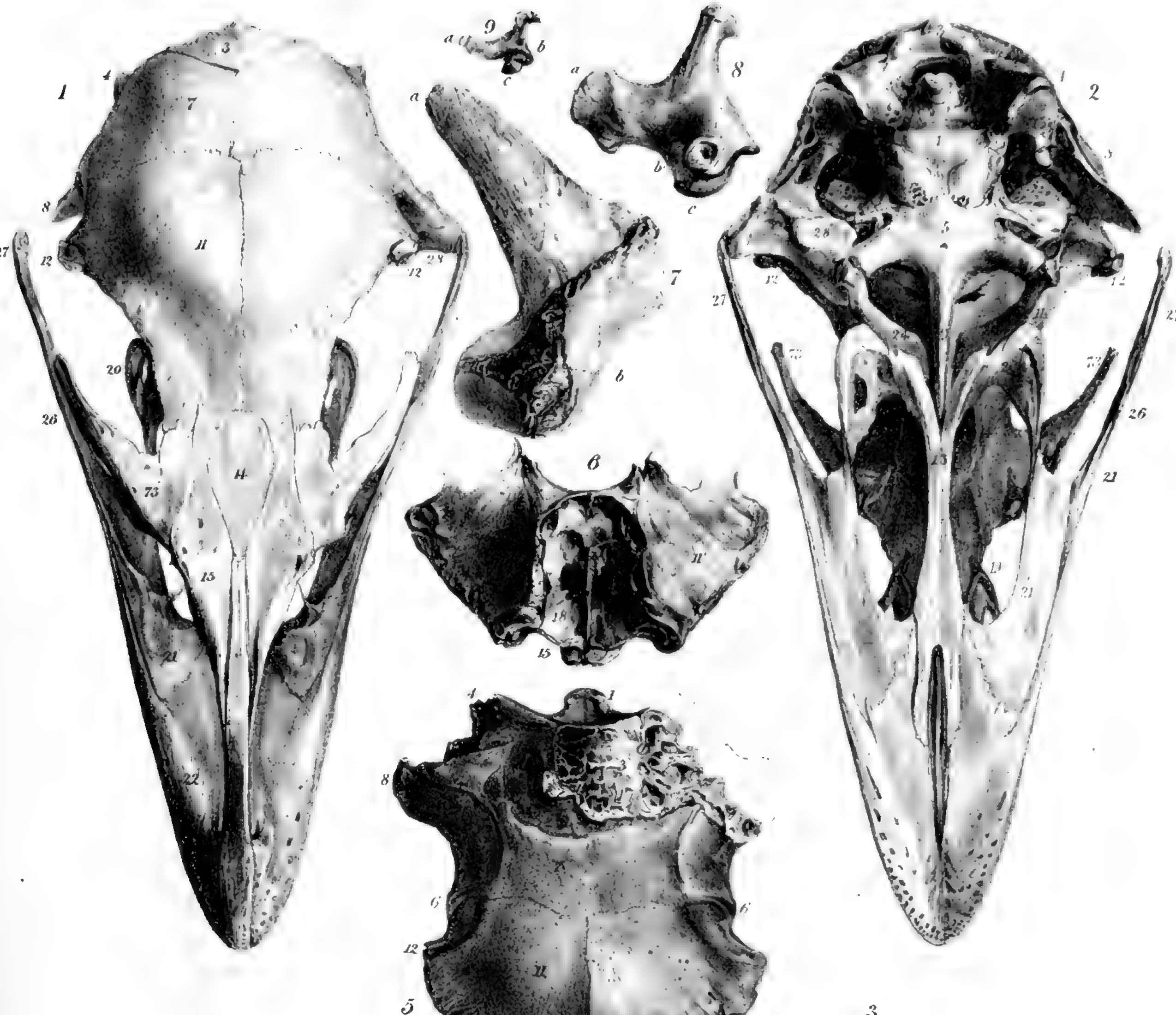


J. Erxleben from nat. on Zinc

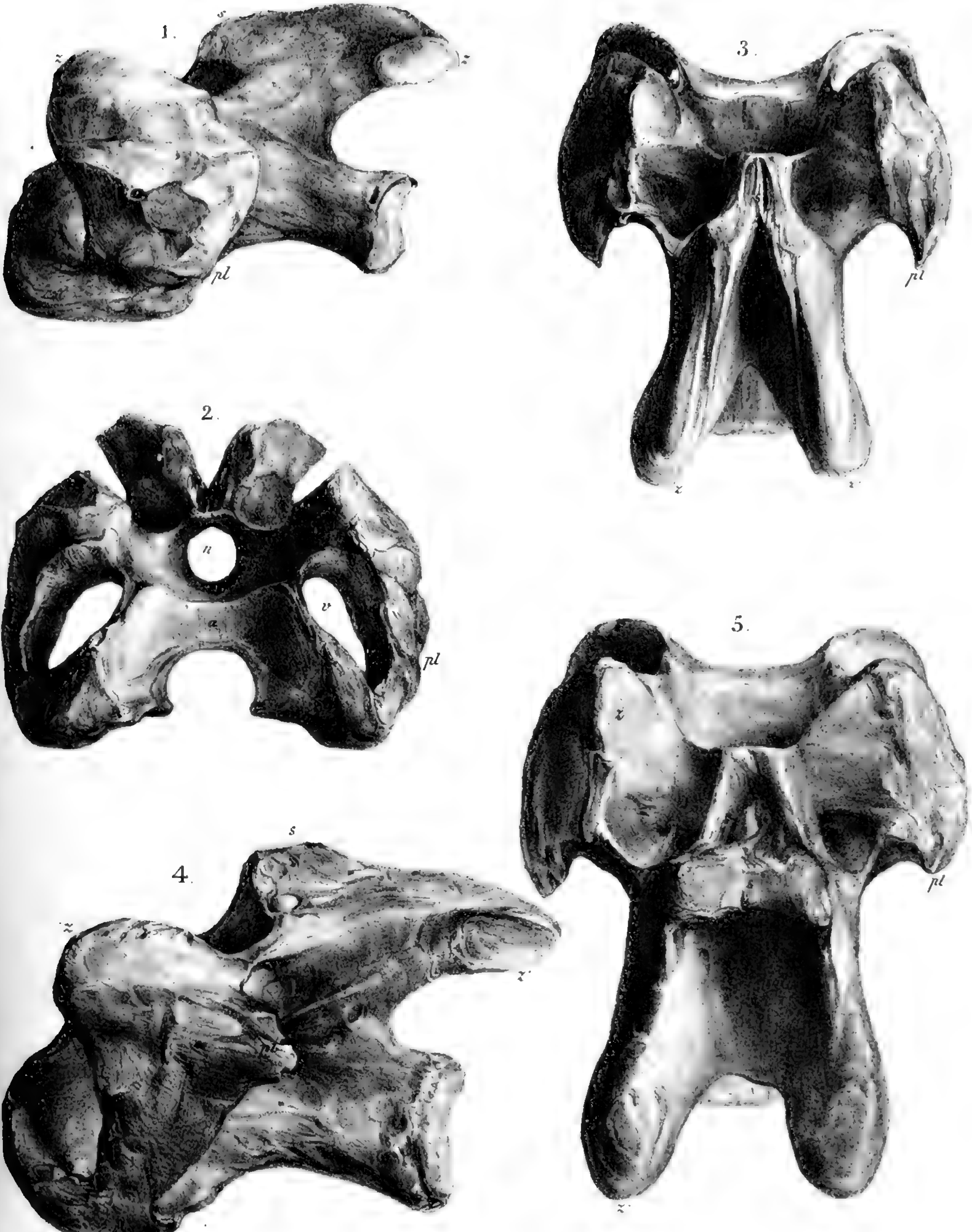
Day & Haghe Lith[rs] to the Queen

1. 4 *Dinornis struthioides* 5 *Didus ineptus*.



J. Erxleben del.

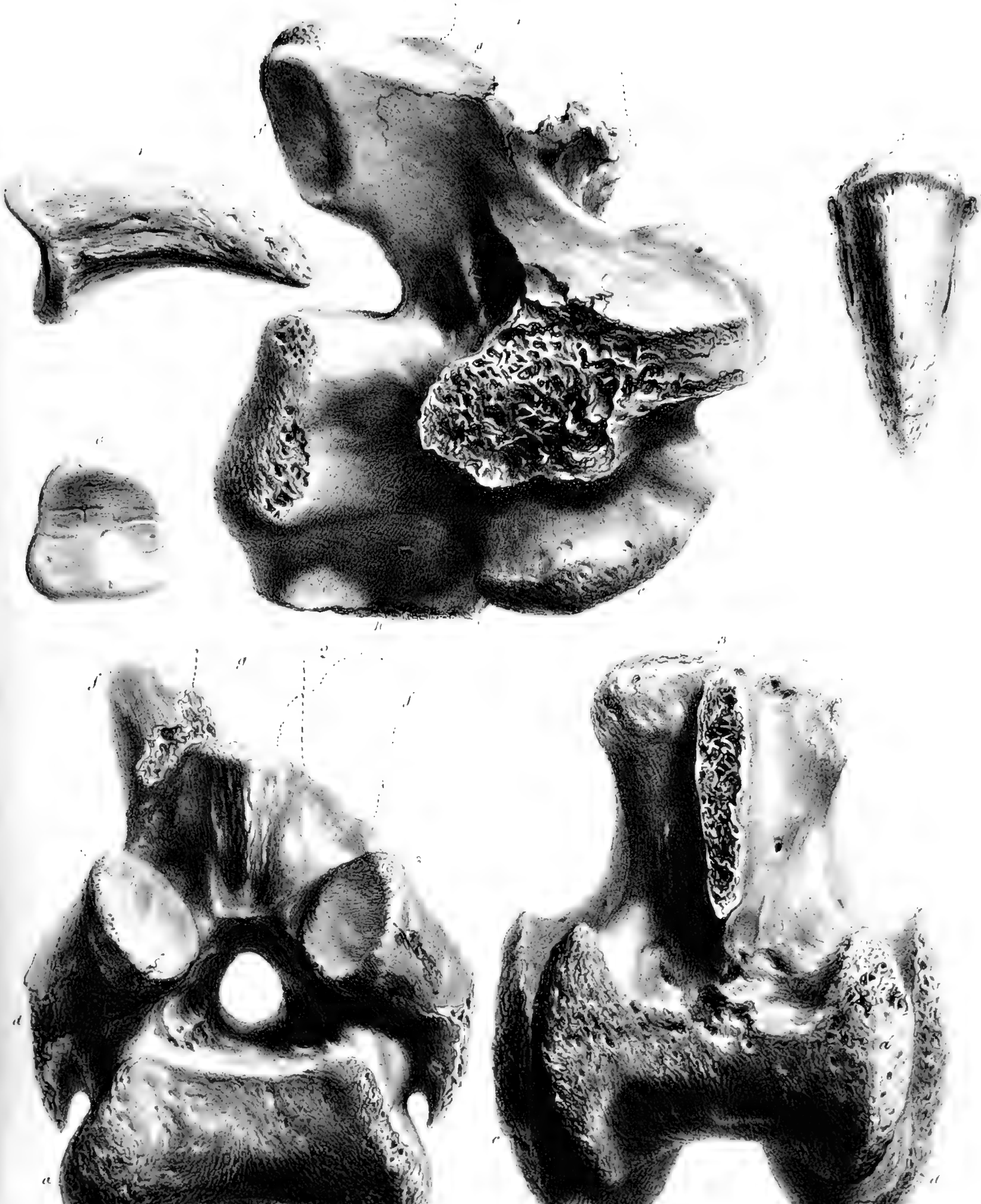
1.2.3 Dromaius. 4.5.6. Dinornis dromioides 7 Dinornis gigas. 8 Struthio 9 Apteryx



J Erxleben Zinc. Nat Size

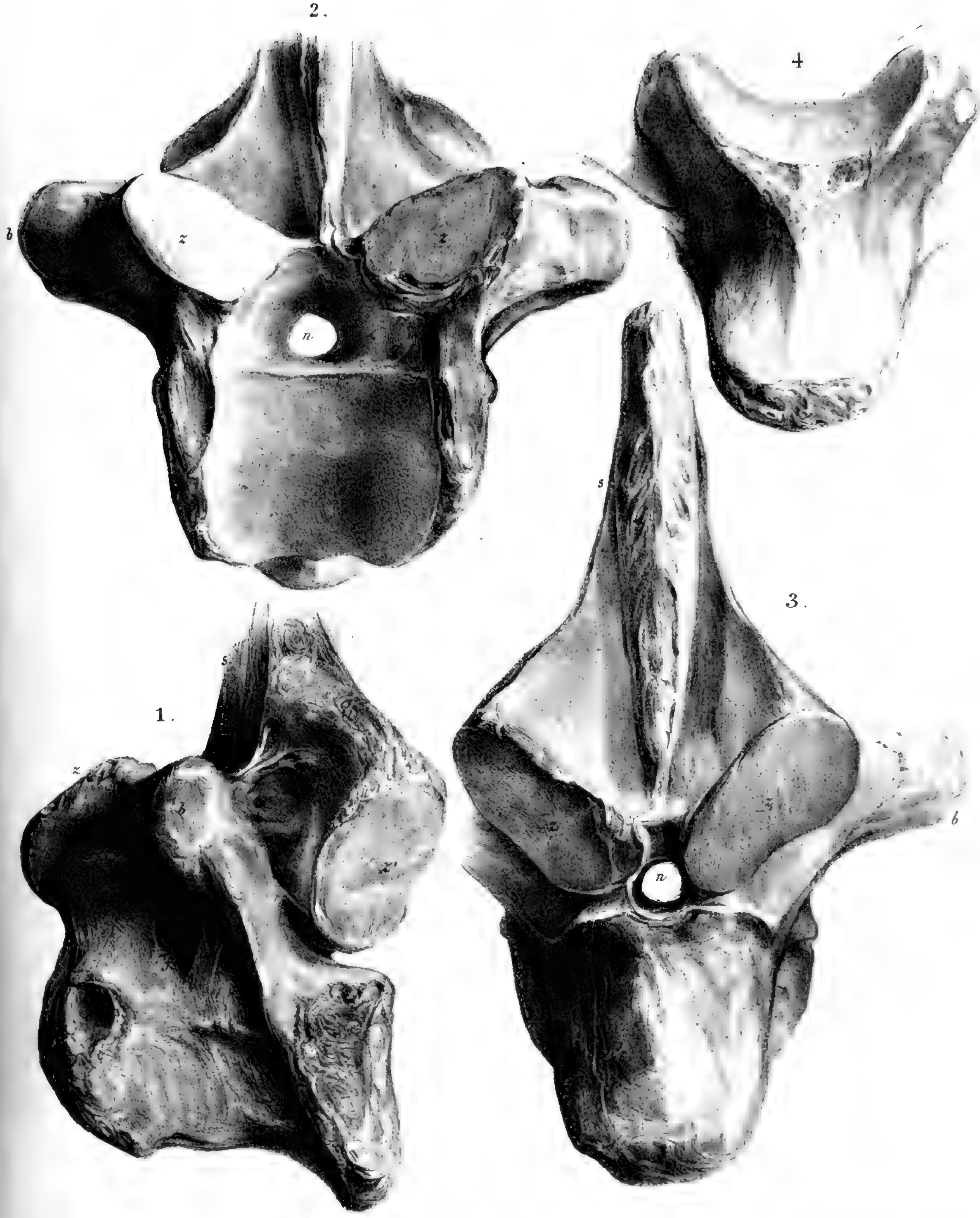
Cervical vertebrae

1. 3. Dinornis ingens 4 – 5. Din giganteus.



Lithog. from Nature by G. Scharf

1_3. Inferior cervical Vertebra. Nat. Size. Dinornis giganteus.



J. Erxleben. Zinc. Nat. Size [illegible] to the Queen

Dorsal vertebrae

1_2. Dinornis crassus (?). 3_4. Din. ingens

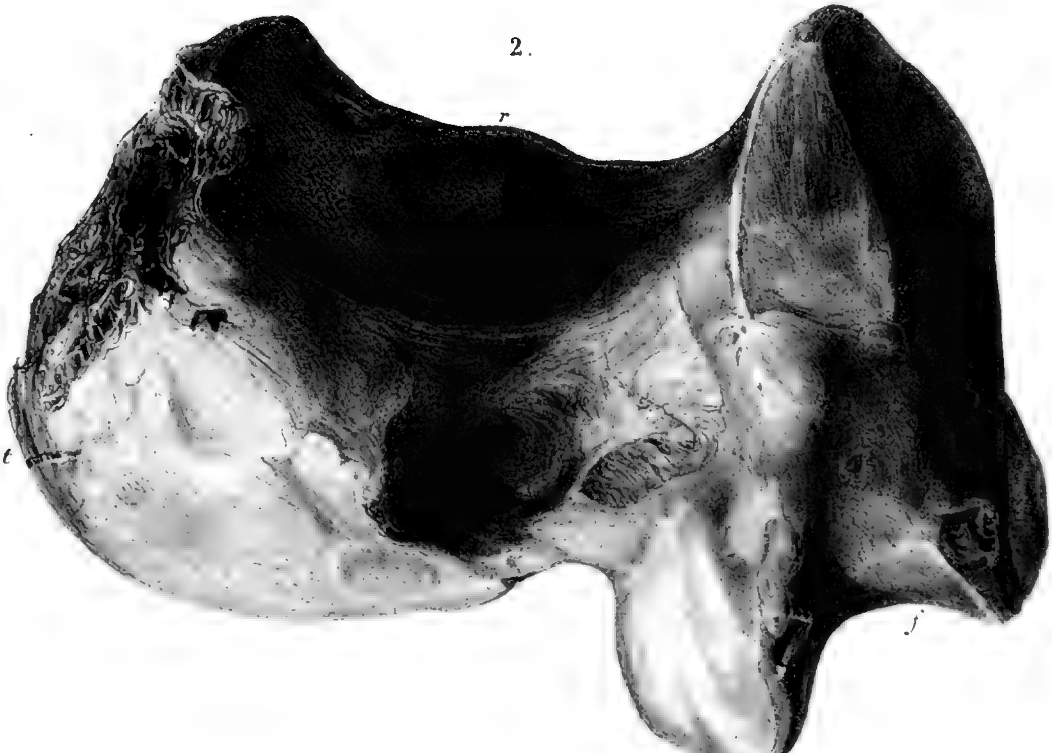
Sternum.

1.2.3. Dinornis _ 4. Struthio _ 5. Rhea _ 6. Casuarius _ 7. Dromaius _ 8. Apteryx.

Day & Haghe Lithrs to the Queen.

1

2.



J Erxleben, Zinc.

Nat. Size

Day & Haghe lith^rs to the Queen

Dinornis giganteus.

1 Dinornis gigas. 2 Struthio. 3 Dromaius. 4 Argala.

J. Erxleben. Zinc

Nat. Size.

Day & Haghe lithrs to the Queen

Dinornis casuarinus.

J. Erxleben. Zinc

Nat. Size.

Day & Haghe Lith.rs to the Queen

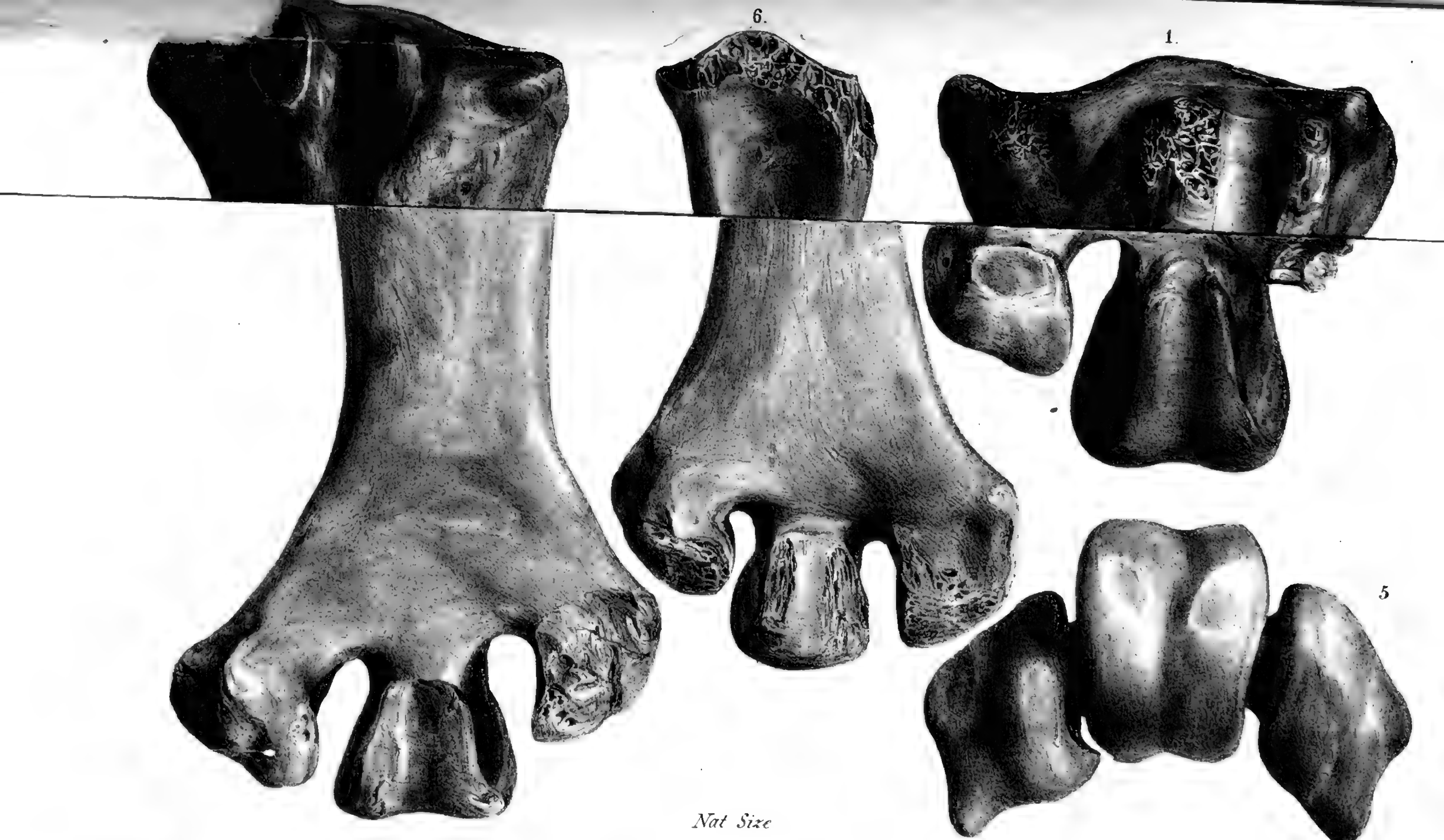
Tibia

J. Erxleben lith.

Nat. Size

Tibia

1 Palapteryx dromioides. 2 Dinornis casuarinus. 3. 5 Din. curtus.



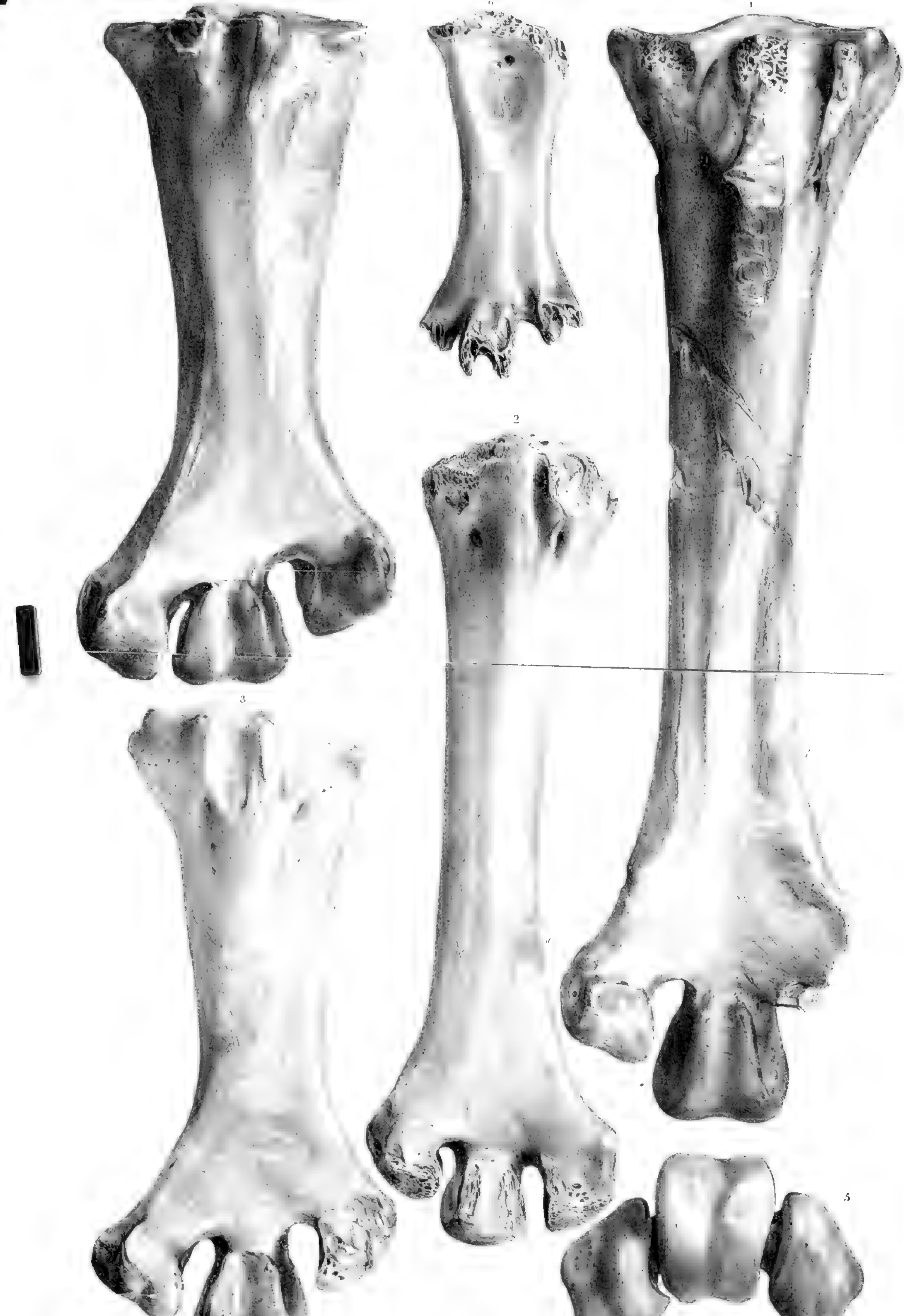
Nat Size

J Erxleben Zinc

Tarso — metatarsus

Day & Haghe lithrs to the Queen

1. Dinornis ingens — 2 Din. dromioides — 3. Din. casuarinus — 4-5. Din crassus. 6 Din curtus.



Nat. Size.

Tarso-metatarsi.

1 Dinornis ingens. 2 Din. dromioides. 3 Din. casuarinus. 4, 5 Din. crassus. 6 Din. curtus.

Erxleben Zinc.

Nat. Size.

Day & Haghe Lithrs to the Queen

1. Didus. _ 2. Haliaetus. _ 3. Apteryx.

J. Erxleben. Zinc. Nat. Size. Day & Haghe lith[rs] to the Queen

1. Didus. _ 2. Haliaetus _ 3. Apteryx.

XV. *On a new Genus of the Family* Lophidæ (*Les Pectorales Pédiculées*, Cuv.) *discovered in Madeira. By the Rev.* R. T. Lowe, *M.A.*, *Corr. Memb. of the Zool. Soc.*, *&c.*

Read September 22, 1846.

THE family of the *Lophidæ* or Frog-fishes, as described in the twelfth volume of MM. Cuvier and Valenciennes' great work, is composed of about fifty species, which are distributed into the five genera—*Lophius*, L., *Cheironectes*, Cuv. (*Antennarius*, Comm.), *Malthæa*, Cuv., *Halieutæa*, Val., and *Batrachus*, Schn.; the affinities of the last-named group being somewhat ambiguous. The addition therefore of an unequivocal new type or genus to a family so circumscribed in extent and singular in character, seems to demand some fuller notice than a mere abstract of its technical distinctions. The present genus has besides some further claims on the attention of the ichthyologist in the annectent combination of its characters, presenting as it were fragments of those exhibited by other groups in the same family, united to peculiar distinctive features of its own; and this independent of the interest attaching to the fish in which they are exemplified for its singularity of form and aspect, brilliancy of colouring, locality, and excessive rarity. During the last twenty years no other instance of its capture in Madeira has occurred; and it seems quite unknown to the fishermen, by whom, however, the individual here figured was at once, sagaciously enough, referred to the *Diodontidæ* or Toad-fish tribe, as "a kind of *Sapo*," which is their name for the *Diodon reticulatus*, L., or the still more common *Tetrodon marmoratus*, nob.; to the first of which, in shape and habit, it bears indeed a strong resemblance.

Its true affinity is nevertheless unquestionably with the *Lophidæ*; and amongst these, in general habit and aspect most with *Cheironectes*, Cuv., although in technical characters it may seem to approach even nearer to *Halieutæa*, Val. It is however rather Cheironectiform than Tadpole-shaped, though it is thicker and more Diodontiform, or swollen and inflated in the body, than even *Cheironectes*. It may be said to stand to *Halieutæa* much in the relation in which *Cheironectes* stands to *Lophius*, having the single dorsal fin and being devoid of filaments or cilia, like *Halieutæa*, but having the elevated back of *Cheironectes*. It has a nearer relation however to *Halieutæa* than *Cheironectes* has to *Lophius*, in the rough skin and wide transverse horse-shoe-shaped mouth and gape.

The individual here figured, and which I shall now proceed to describe, was taken with an ordinary bait and line at the Picos, a rocky shoal about a league from the shore off Camera de Lobos, a village five or six miles to the westward of Funchal, on the twelfth of March last. It is placed in the Society's Museum.

CHAUNAX.

Char. Gen.—*Corpus* subcubico-oblongum, sufflabile, nudum, cute præsertim ad ilia ventremque flaccidissimâ laxâ; anticè obesum, posticè abruptè attenuatum subcompressum. *Caput* osseum magnum subtetrahedrum, supernè nuchâque latum planatum, utrinque s. ad genas declive; oculis lateralibus spatio interoculari convexo; ore rictuque amplissimis transversis plagio-plateis s. depressis. *Dentes* intermaxillares vomerinique palatinique parvi scobinati. *Nares* simplices (nec pedicellatæ nec tubulosæ). *Spiracula* (foramina branchialia) postica s. ad ilia pone pinnarum pectoralium axillas.

Pinna dorsalis unica; pectoralibus (pedicellatis) carnosis; ventralibus jugularibus spathulatis carnosis; analis postica; caudalis simplex truncata.

Cirri, præter unicum in fossulâ internasali, nulli.

CHAUNAX PICTUS, nob.

D. 11; A. 5; P. 11; V. 4; C. $\frac{1 + \text{IV.}}{2 + \text{II.}}$.

Species adhuc unica.

Hab. In mari Maderensi.

Shape rather that of *Ostracion* or *Diodon* than of either *Lophius* or *Cheironectes*; i. e. neither depressed nor compressed, but both thick and deep, that is subcubic or coffer-shaped and about half as deep as broad, with a puffy flaccid appearance, and evidently capable of vast inflation; bulky forwards, with the head, nape and body of equal size or depth and thickness, the latter contracting suddenly at the flanks or behind the pectoral fins into a short thickish tail. Back of head and nape as far as the dorsal fin broad and thick, flattened, and uneven or irregularly protuberant; thence to the end of the dorsal fin the body is nearly cylindric, becoming compressed towards the root of the caudal fin.

Head both broad and deep, bony, and resembling that of *Diodon reticulatus*, L., with the eyes lateral and separated by a convex space, as in most fishes: the sides of the head steep, but not flat. Mouth like that of a Toad or Toad-fish, very large and wide, but not so wide as the head, horse-shoe or crescent-shaped. Upper jaw or muzzle very short and broad, with a wide notch at its tip. The lower jaw projects considerably beyond it, turning upwards as in *Uranoscopus*, *Beryx*, or *Priacanthus*. Maxillary rough, distinct and broad downwards, playing freely as usual in its smooth groove. Lips in both jaws smooth and distinct; in the lower, broad. Teeth in a distinct brush-like band on the edges of both jaws (confined to the intermaxillaries in the upper), as on the palatines and vomer; close-set and equal as in *Beryx*, and though small, yet pretty sharp and strong. The tongue is very large and conspicuous, thick, white, hard or bony, and quite smooth. The nostrils are two inconspicuous, minute, round, simple pores on each side, one a little before the other near the edge of the muzzle, in a smooth, irregular pit or hollow, about the distance of the diameter of the eyes on each side the medial frontal line. They are so small and obscure that they may be easily overlooked. A line drawn through them backwards falls considerably above or within the orbit of the corresponding eye. The hinder edge of the anterior larger nostril is a little raised or produced and fimbriate. The hinder nostril is a mere simple smaller pore. Eyes of moderate size, roundish-oval, rather prominent or convex, but in no degree protruded or pedicelled, as represented in the Fishing-frog by Cuvier and Valenciennes, t. 362; appearing as if encased or covered with a pellucid glassy skin or jelly, within which is seen the iris of a bright golden yellow tinged with orange, and the large black pupil. The orbits are quite plain and simple, flat, skinny, and unarmed, like the whole head, with either spines or crests. They are placed about twice their own diameter apart.

In the middle of the front of the muzzle, a little before a line drawn across from the fore-edge of one orbit to that of the other, there is a short, pedicelled, soft, flaccid tentacle or caruncle, shaped like some little stipitate Fungus (*Spathularia* or *Mitrula*), with the head ovato-lanceolate and fimbriato-corrugate. This tentacle is scarcely more than a semi-diameter of the eye in height or length, and falls back into an oval hollow or depression, in which it may easily escape observation. The whole head, as well as nape or dorsal ridge, and indeed the whole body, are destitute of any other tentacle, ray, filament or spine whatever. Neither is there any sort of rudimentary fin, in the shape of hump, horn, crest, or tubercle on the head, nape, or back before the dorsal fin. The top of the head and the nape are however irregularly knobbed or uneven, with bony prominences and depressions.

The breathing-holes or branchial orifices are placed far backwards, not in, but considerably behind the hinder axils of the pectoral fins, in the middle of the flanks, which are peculiarly flaccid and skinny or flabby. They are oval, ear-shaped, and about the size or diameter of the eyes.

The dorsal fin is single, placed nearly in the middle of the whole length of the head and body together, beginning only the diameter of the eye, nearer the tip of the upper jaw than the middle point between the same tip and the root of the caudal fin. Its height vertically is one-fourth of the length of its base, which is in its turn one-fourth of the whole length of the fish. It has eleven rays, with a small tubercular rough prominence at the base of the first ray in front, which might perhaps be called a rudimentary twelfth ray. The first ray of the eleven is short, the two next gradually longer; the fourth, fifth and sixth are the longest, and the rest become gradually shorter. The rays are all simple and rough, with their tips a little produced beyond the web, which is quite smooth and shining. The whole fin resembles much the dorsal fin in *Cheironectes*.

The anal fin is placed far behind, opposite the end of the dorsal, which in shape it resembles, being only much smaller and shorter, with the last four of its five rays nearly equal. Its height vertically is nearly half the length of its base, which is little more than one quarter of the length of the base of the dorsal fin. The whole fin is smooth and very rude or thick and fleshy; the rays, though strong, being quite indiscernible to the eye, and not scabrous, as they are in the dorsal fin.

The pectoral fins are placed low down about the middle of the length of the body, not reckoning the caudal fin; in other words, beneath the origin of the dorsal fin. They are cheironectiform, with a distinct wrist and elbow, square-shaped, truncate, and slightly crenate at the outer edge, but thick and fleshy; above smooth and shining only towards their outer margin; beneath altogether so. The rays are eleven in number, strong, but only to be reckoned by feeling for them.

The ventral fins are placed close together, very forward, quite under the throat: they are rather small and of a singular narrow elongato-spathulate form, thick, smooth and fleshy, with only four rays, which are quite indiscernible to the eye.

Caudal fin resembling that of a *Balistes*, simple, truncate, with a straight edge: the six principal rays are very strong, rough or scabrous, and much branched. The web between the rays is smooth.

All the fins, except the dorsal and caudal, are thick and fleshy, with the rays strong but indiscernible to the eye, except it be towards the outer edges of the pectoral fins.

The whole head and body of this fish, with the maxillaries and the rays of the dorsal and caudal fins, are finely hispid or shagreened, and rough or scabrous to the touch, like a rasp. On the top of the head, nape, or back, this roughness or hispidity is shorter, as if close-shaven, and approaches more to granular; but below the lateral line of pits, and especially on the chin, and towards the caudal fin and on its rays, the skin is almost velvety to the eye. The under surface is more finely shagreened than the upper, and the pectoral fins beneath are, like the ventral and anal fins, wholly smooth. There is also a smooth loose skinny space about the air-holes on the flanks.

The whole skin is singularly loose and flaccid, pulling up into longitudinal folds or plaits, even on the back, and forming on the flanks great vertical or annular wheals or welts.

It remains to describe the curious chain-like rows of pits, or oblong, shining, smooth depressions in the skin, by which the head and body are, as it were, mapped out into compartments.

One set or row of these begins upon the muzzle, on each side the hollow for the tentacle near the tip of the upper jaw, and passing above or inside each eye, turns downwards behind it, following its circumscription; and then again turning backwards on a level with its lower edge, runs straight along the sides as far as the breathing-holes, over which it turns a little obliquely downwards, continuing thence straight along the tail, but rather below the middle of it, to the caudal fin. This row seems to represent the lateral line.

Under the lower jaw is a horse-shoe-shaped space, inclosed by similar smooth pits, the two ends of which, connected by a transverse chain of pits, turn off backwards on each side towards the corners of the mouth, and are continued along each side of the fish in a straight line low down on the sides of the belly, passing over the base or root of the pectoral fins, and ending underneath their hinder axil.

A third wavy row or chain of like smooth shining pits runs along the edge of the suborbitaries over against the inner or hinder edges of the maxillaries, down nearly to their lower end, and then turns obliquely backwards some distance underneath the eye, across the cheeks, descending a little till it meets nearly at right angles, and is terminated by

A fourth obliquely vertical row, which crosses the nape like a head-stall, dividing, as it were, the head from the body, running across a little behind the eyes, and crossing the first-described rows or lateral line at right angles. This head-stall descends obliquely forwards towards the throat at about two-fifths of the distance from the corners of the mouth to the pectoral fins, and is terminated lower down on the sides of the throat by the second longitudinal low ventral row proceeding from the horse-shoe under the chin. On the nape the edges of these pits are raised or echinulate, and they are more disconnected than elsewhere, only six being contained in the space interoepted by the two lateral-line rows.

Colour of the whole fish above bright orange, beautifully rosy at the flanks and sides, and with the fins and lips vermilion. Beneath, or on the belly, it is nearly white or pale, suffused with flesh-colour or rosy, and with the ventral and anal fins deeper vermilion.

Examined more closely, the whole upper surface of the head and body is found to be finely mottled or reticulated with vermilion on a bright (King's) yellow ground, the red forming the reticulations amongst the yellow spots or meshes. The fins and lips and intermaxillaries are however uniform vermilion or bright rosy red.

The tentacle is dull blue; its stalk orange.

Measurements.

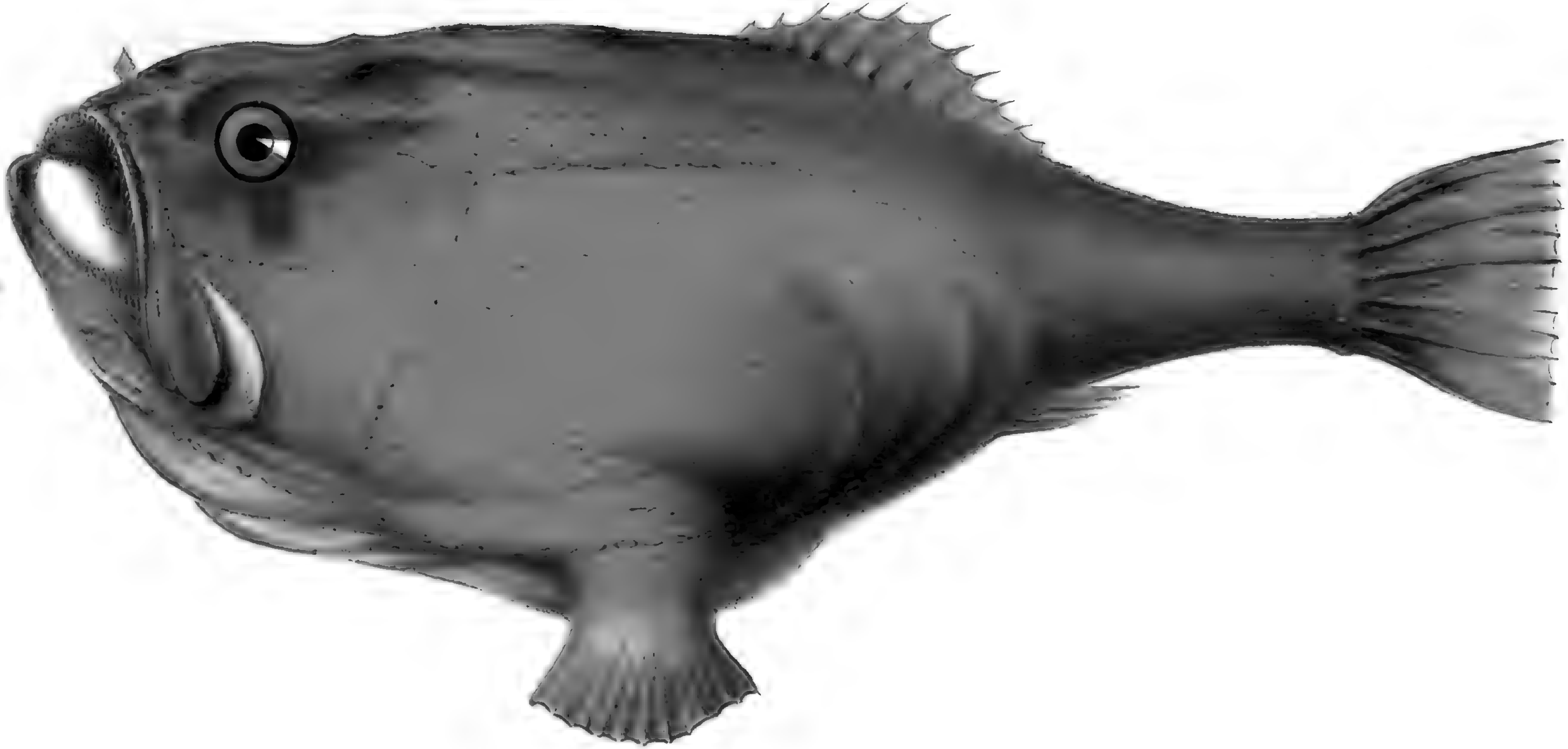
		inches.
Whole length from tip of *lower* jaw to end of caudal fin		16
From tip of *upper* jaw to origin of dorsal fin	6	$15\frac{1}{4}$
Length of base of dorsal fin	4	
Length from end of base of ditto to root of caudal fin	2	
Length of caudal fin	$3\frac{1}{4}$	
Length of head		5
Breadth, greatest at fore axil of pectoral fins		from 8 to 10
Depth, greatest half-way between tip of upper jaw and origin of dorsal fin		4
Depth at root of caudal fin		1
Length from tip of *lower* jaw to root of ventral fins		4
Length of ventral fins		$2\frac{1}{4}$
Length from each breathing-hole to root of caudal fin		5
Diameter of eyes		$0\frac{3}{4}$

From the foregoing description it will be seen how *Chaunax* differs from each of the other five genera of *Lophidæ*.

Whilst *Cheironectes* seems its most natural, *Halieutæa* is its nearest technical ally. Agreeing with *Lophius* in the wide transverse mouth, and in the backward position of the breathing orifices on the flanks, but with *Cheironectes* more in shape, and in the granular or velvety roughness of the skin, in colours it differs from both, and approaches *Halieutæa* in the absence of crests or cilia on the back, and in the single dorsal fin. In these last two points, and in the roughness of the skin, it agrees with *Halieutæa*, but differs in its Diodon-like shape, and in the position of the breathing-holes considerably behind, instead of above or before, the axils of the pectoral fins.

I am indebted to the able pencil of the Rev. E. H. Woodall for the spirited and accurate drawing from which the illustration was taken.

Madeira, July 28, 1846.



Chaunax pictus.

XVI. *On* Dinornis (Part III.): *containing a Description of the Skull and Beak of that genus, and of the same characteristic parts of* Palapteryx, *and of two other genera of Birds,* Notornis *and* Nestor*; forming part of an extensive series of Ornithic remains discovered by* Mr. Walter Mantell *at Waingongoro, North Island of New Zealand. By* Professor Owen, *F.R.S., F.Z.S. &c. &c.*

Read January 11th, 1848.

SELDOM has a new idea more rapidly reached its full development than that of the former existence of gigantic terrestrial birds in New Zealand, suggested by the fragment of bone from that island described and figured in the 'Transactions of the Zoological Society' for 1839, vol. iii. p. 29. pl. 3. Three years had scarcely elapsed when other remains, transmitted from New Zealand, led to the determination of one genus of these birds and to the indication of five species, one of the astonishing stature of ten feet, by the characters of bones of the trunk and extremities[1]. In 1846[2] a second genus of large terrestrial bird, together with four additional species, and two at least well-marked varieties, were established, principally by specimens of bones of the extremities: different vertebræ, ribs, and a sternum, were at the same time contributed towards the restoration of the entire skeleton of the extinct gigantic bird, and the cranial portions of the skull of two distinct species were described, and compared with that of the Dodo, so far as its characters could then be deduced from the dried head at Oxford[3].

No trace, however, of the beak of either of the genera indicated by the bones of the extremities had then reached England: but in the 'Athenæum' of September 25th, 1847, Dr. Mantell, F.R.S., announced that his son, Mr. Walter Mantell, of Wellington, New Zealand, "in an exploring tour in search of the remains of the colossal Ostrich-like birds which once inhabited New Zealand, and whose bones occur in the alluvial sand and silt of the rivers,"—"had discovered imbedded with the bones, fragments of their eggs;"—that the bones collected and on their way to England amounted to 700 or 800 in number; and included "portions of several skulls and mandibles."

About four weeks ago I was favoured by an announcement from Dr. Mantell of the arrival of the collection, accompanied by a most friendly invitation to inspect and describe it; and I soon had the extreme pleasure of viewing the unrivalled series of

[1] Op. cit. vol. iii. p. 235. pls. 18–30 (1843).

[2] Tom. cit. p. 307. pls. 38–50.

[3] The casts of the cranium of the Dodo, which the authorities of the Museum of Natural History of Copenhagen have liberally transmitted, and the exposition of the bones of the dried head at Oxford which the accomplished Curator of the Ashmolean Museum permitted to be made for the communications, by Messrs. Strickland and Melville, at the Meeting of the British Association at Oxford, on the extinct Birds of the Mauritius and neighbouring isles, have permitted the requisite comparisons to be carried further in the present Memoir.

these interesting remains, for which science is so much indebted to the exertions of his enterprising son.

The bones are in a different state from that of any which I had before seen: instead of the deep brown tint, tenacity and heaviness of those from Wairoa, Waipu, and the beds of the streams that run east of the volcanic chain of Tongariro, which had been transmitted by the Ven. Archdeacon Williams, the Rev. W. Colenso and the Rev. Mr. Cotton, in 1843, they are yellowish-grey or fawn-coloured, light and fragile, with their articular surfaces entire and smooth and all their ridges and processes singularly sharp and perfect; most of the fractures being recent and some evidently the result of accident in the transport: they are all, however, more or less absorbent from the loss of animal matter[1]. They have a different aspect also from those remains obtained by Dr. Mackellar and Mr. Percy Earl from the submerged deposits of the shore at Waikewaite in the Middle Island; these are of whitish-grey colour, and though light and friable retain more elasticity, and more of the animal matter; they do not stick to the tongue.

In a note dated December 23rd, which Dr. Mantell addressed to me, he writes, "My son obtained the greater part from fissures and caves, imbedded in a loose volcanic sand and ash:" and in a subsequent communication (December 25th, 1847) Dr. Mantell states, "the greater part were obtained from Waingongoro" (North Island) "in loose volcanic sand." But in a letter which Col. Wakefield has addressed to J. R. Gowen, Esq., dated "Wellington, New Zealand, 12th August 1847," he writes that the "Moa's bones transmitted to England by Mr. Mantell were collected by him between Wanganui and Taranaké at the mouth of the river 'Wanganui'."

In proceeding to determine and classify the specimens at the request of Dr. Mantell, I had the same gratification, as at the first inspection of the series of bones brought home in 1846 by Mr. Percy Earl, in recognising the specific characters, which had been deduced in the first instance from a few specimens or fragments of bone, perfectly repeated in numerous examples of entire femora, tibiæ and metatarsi. Thus after setting apart, of—

	Femora.		*Tibiæ.*		*Fibulæ.*		*Metatarsi.*	
	Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.
Dinornis casuarinus	1	1′	1	1	1	1	1	1
——— *didiformis*	9	5	3	2	3	3	1	2
——— *curtus*	0	0	5	3	8	8	2	3
Palapteryx dromioïdes	4	7						
——— *geranoïdes*[2]	10	5	8	8	9	4	7	6
there remained of the *Palapteryx ingens* var. *robustus*	1	1	1	0	2	1		

[1] Some portions of a human skeleton, including a clavicle, part of a radius, and a few phalangeal bones, together with half the lower jaw of a Dog, transmitted with the birds' remains, have been reduced by heat to their constituent white earthy matter. Not any of the bones of the *Dinornis* are in this state, though some have been blanched or partially blanched by exposure.

[2] An unpublished species defined from certain leg-bones sent home by the Rev. Mr. Cotton since the communication of my former Memoir, Part II.

and of *Dinornis giganteus* the right and left fibulæ, the proximal end of a left tibia, and both proximal and distal ends of a right tibia of apparently the same bird. In one of the specimens, which is nearly full-sized, the distal epiphysis of the tibia is ununited.

Of the numerous series of vertebræ (250 in number) seven were referable to *Dinornis giganteus*, four to *Palapteryx ingens*, eighteen to *Dinornis casuarinus*, together with twelve others, forming a continuous series of the neck-bones, corresponding with the vertebræ referred to *Palapteryx ingens* in my former Memoir[1].

There are still more complete series of cervical and dorsal vertebræ referable by their size to *Dinornis didiformis*, *Din. curtus*, *Palapteryx geranoïdes*, and to the species indicated in the Memoir of 1843 as *Dinornis otidiformis.*

There are, also, sixteen more or less perfect pelves, referable to at least five species, together with numerous ribs and fragments of ribs.

Amongst the rarer and more instructive parts of this collection are some portions of a sternum of a small species of *Dinornis* or *Palapteryx*, and two nearly entire sternums of the new genus *Notornis*, which belongs to the same family (*Rallidæ*) as the rare *Brachypteryx* or short-winged Rail of New Zealand.

There are not fewer than 190 phalanges of the toes referable to five or six species of *Dinornis*, *Palapteryx* and *Notornis*; and there are eight tarso-metatarsal bones, with the articular surface for a very strong hind-toe, and of a conformation more nearly resembling those of the *Dodo* than those of the *Dinornis* or *Palapteryx*, but shorter and thicker in proportion than in the *Dodo*, and appertaining to the same bird as the tibiæ and femora described in my Memoir of 1843 under the name of '*Dinornis otidiformis*.' The proximal articulation of this remarkable form of tarso-metatarsal exactly fits the distal end of the tibia figured in pl. 26. fig. 5. vol. iii.; and also that of a corresponding fractured tibia in Mr. Mantell's collection, which also contains the proximal end of another tibia, a fibula, an entire femur and distal ends of two other femora of the same species.

The large surface for the hind-toe; the strong calcaneal process, perforated by a complete bony canal for the tendon at the back part of the proximal end of the tarso-metatarsal; the perforation above the interspace between the condyles for the middle and outer toes; and the more posterior position of the condyle for the inner toe,—all concur to indicate the generic distinction of the bird to which it belonged from either *Dinornis* or *Palapteryx*; and I propose to indicate the new genus by the name of *Aptornis*[2]. The present species, *Aptornis otidiformis*, resembles the *Apteryx* in the shortness of the metatarsal as compared with the length of the tibia. Amongst all this collection there is but one bone of a wing—a humerus—which bears the same proportion to the femur referred to *Notornis Mantelli*, which the humerus of the little existing *Brachypteryx* does to its femur.

[1] (Part II.) p. 314. pl. 40. figs. 1 & 3.

[2] By syncope for 'Apterygiornis,' from α priv., πτέρυξ wing, ὄρνις bird.

With the bones of the birds are associated fragments of large birds' eggs, noticed by Dr. Mantell in the 'Athenæum,' September 25th; some ossified rings of a bird's trachea, about half an inch in diameter; several bones, including jaws and teeth, of a large Seal of the genus *Arctocephalus*; and a few bones of a small Dog, besides the calcined bones already alluded to, which include some that have indubitably appertained to a human skeleton.

Of this extremely rich and interesting acquisition to our materials for working out the zoological history, past and present, of the distant isles of New Zealand, I have selected for the subject of the present communication the bones of the head and beak, which indicate not fewer than four distinct genera of birds.

The largest and most complete specimen, with a broad, depressed, subelongate beak, regularly but moderately curved downwards, resembling a cooper's 'adze' (*doloire*, Fr.), with evidence in the skull of unusual muscular forces for working such beak, I refer to the genus *Dinornis*. The second skull, of nearly equal size, with a beak more resembling that of the Emeu, and with characters of the skull which deviate less than those in *Dinornis* from the cranial organization of the *Apteryx*, I refer to the genus *Palapteryx*, indicated in my former Memoir by certain characters in the bones of the legs approaching those of *Apteryx*. The two cranial fragments there described belong to this genus. The third genus, which I propose to call *Notornis*, is represented by a smaller species about the size of a Turkey or Bustard, but allied closely to the purple Rail (*Porphyrio*) and to the short-winged Rail of New Zealand (*Brachypteryx*). The fourth genus belongs to the family *Psittacidæ*, and is represented by bones of the upper bill, resembling those in the New Zealand Maccaw (*Nestor hypopolius*). There is a portion of the lower jaw which from its size may have belonged to the *Palapteryx ingens*, if not to the *Dinornis giganteus*.

Skull of the Dinornis casuarinus (Pl. LII.).

The cranial portion of this skull is intermediate in size between that figured in pl. 38. figs. 1—4, and that in pl. 39. figs. 4, 5 & 6, of my former Memoir (Part II.), p. 307; and if the reference of the larger of those crania to *Palapteryx struthoïdes*, and of the smaller one to *Palapteryx dromioïdes* be correct, the present skull may be referred to the *Dinornis casuarinus*. The following are a few of the comparative dimensions of these crania, and of one referable to the *Palapteryx geranoïdes*.

	Palapteryx struthoïdes.		Dinornis casuarinus.		Palapteryx geranoïdes?		Palapteryx dromioïdes.	
	inches.	lines.	inches.	lines.	inches.	lines.	inches.	lines.
Breadth of the cranium across the mastoids (8, 8) ..	3	3	2	9	2	5	2	7
Length of the cranium to the anterior border of the coalesced frontals (11)	....		2	11	2	8	2	8
Breadth across the postorbital angles	....		3	0	2	10	2	2
Breadth across the temporal fossæ	2	5	1	11	1	9	1	9
Vertical diameter from supraoccipital ridge to basisphenoid	1	6	2	1	1	3		
Transverse diameter of occipital foramen	0	7	0	6	0	$5\frac{1}{2}$	0	$6\frac{1}{4}$
Breadth across the paroccipitals (4, 4)	....		2	11	1	10		
Total length of skull, in a straight line	....		6	2				
Total length of premaxillary	....		4	3				
Breadth of base of upper beak at fore-part of frontals	....		1	3				
Breadth of the middle of the upper beak	....		1	1				
Breadth of the extremity of the upper beak	....		0	6				
From the fore-part of the external nostril to the end of the beak	....		2	3	0	10		
From the fore-part of the palatal nostril to the end of the beak	....		1	8	1	0		
Length of the palatal nostril	....		1	10				
Breadth of the palatal nostril at middle	....		0	4				

The cranium of the *Dinornis* in its general broad and depressed form, in the pedunculate condyle, in the vertical plane of the foramen magnum (fig. 4, *o*), in the direction from below upwards and forwards of the broad and low occipital surface (fig. 1, 3), in the slight convexity of the parietal region (fig. 2, 7), and in the wide and deep temporal fossæ (fig. 1, *t*, 8″, 12), repeats the characters exhibited by the previously described specimens of the cranium of *Palapteryx* (pp. 308–313, pls. 38 & 39). But some of these cranial peculiarities of the great extinct wingless birds are exaggerated in the typical genus, especially the downward development and abrupt descent of the basioccipital and basisphenoid (fig. 4, 5) and the forward inclination of the occipital surface, which makes the occipital condyle (figs. 4 & 6, 1) the centre of the hinder surface of the skull, and places the occipital foramen (*o*) in the upper half—characters hitherto unknown in the air-breathing Vertebrata; amongst which the *Crocodilia*, perhaps, present the nearest approximation to the peculiar structure exhibited in fig. 4.

The occipital condyle (1) is a hemispheric tubercle, impressed by a subcentral pit, supported on a short thick peduncle, and projecting beyond the vertical line dropped from the upper border of the foramen magnum. It presents a similar form in *Otis* (fig. 8), but is sessile and overhung by the upper border of the foramen, as it is likewise in *Didus*, in which the condyle is a transverse reniform tubercle with a median notch above. The basioccipital expands as it descends with a curve concave backwards; but, passing into the basisphenoid which continues the descending surface and inclines forwards, the curve becomes convex backwards, and thus describes a sigmoid line in the vertical direction: the lateral borders of this broad subquadrate occipito-sphenoidal plate (1″, 5′, figs. 4 & 6) are bent backwards, making the whole surface concave transversely. The upper portions of the lateral borders (1″) form compressed angular plates, with the angle rounded off; the lower portions (fig. 3, 5′) expand into thick rough surfaces which appear to have been capped by cartilage. At the anterior end of these surfaces, which are but two lines apart at the middle of the basisphenoid, that bone rises abruptly at an acute angle for the extent of half an inch before it reaches the base of the presphenoid, from which it is defined by a transverse groove (fig. 3, *e*) passing between the two outlets of the osseous parts of the eustachian tubes. The fore-part of the basisphenoid is similarly defined in *Otis* (fig. 8); but its under surface is flat, with two tuberosities posteriorly. It offers, however, a certain resemblance to the basisphenoid of *Dinornis*, in the presence of a broad ridge on each side (5″) connecting the basisphenoid with the paroccipital processes. The basisphenoid in *Didus* presents a longitudinal channel bounded by parallel lateral ridges; the sides of the basisphenoid which incline to these ridges are slightly concave, have two perforations posteriorly, one above and a little in advance of the other, and form the anterior and inner boundary of the tympanic cavity.

The fore-part of the wedge-shaped basisphenoid in *Dinornis* presents a smooth subquadrate surface convex forwards from side to side, like a half-cylinder. There is a median vertical depression on the basioccipital, a little below the condyloid peduncle; and three minute foramina (fig. 4, *v*) on each side the base of that peduncle.

The precondyloid (*p*) and carotid (*c*) foramina open externally into a large fossa common to them and some pneumatic holes communicating with the diploë of the exoccipitals immediately external to the back part of the lateral basioccipital ridges: there is a similar depression for the two foramina on each side in the Dodo and the Bustard. The exoccipitals send each a small tuberosity inwards where they form the sides of the foramen magnum (fig. 4, *o*), which sides expand and are impressed by a well-marked vertical groove for the 'sinus occipitalis' behind those tubercles, which have a narrower groove in front of them. The form of the foramen is that of a vertical ellipse with straight sides: its upper border is continued on each side downwards and outwards upon the obtuse angle dividing the exoccipital (2) from the paroccipital (4) surfaces; the angle terminating below in a short process or ridge bounding a muscular impression. This impression is continuous with other roughnesses for muscular attachment extending over the whole inferior irregular surface of the paroccipital. This surface (figs. 3, 6, 4′) abuts upon the outside of the basioccipito-sphenoidal plate (5′), and widens as it extends outwards to terminate in a concavity on the under part of the paroccipital angle (4, fig. 3): its smaller mesial or inner end offers a rough articular surface for the stylohyal (38), which was anchylosed to this surface on one side (as shown in figs. 3 & 6): there is a tuberosity (4′, fig. 3) midway between the outer and inner ends. The extent of the paroccipital, to which the great breadth of the occipital region is due, is a striking characteristic of the *Dinornis*. The foramen magnum is longest vertically in *Didus* with lateral processes encroaching upon it, but the upper half so defined is narrower than in *Dinornis* and almost pointed above; the margin of the foramen is broad and excavated; it is perforated above by a median supraoccipital foramen and by two lateral holes. The supraoccipital of *Dinornis* (3) inclines forwards at an angle of 43° to the horizontal line of the *basis cranii* (fig. 1, 3); it is imperforate above the great foramen. The occipital surface is defined from the upper or parietal surface by a well-marked ridge which describes two strong curves, convex forwards (3, 3, fig. 2), bounded by a thick tuberosity (*t*) externally, from which the ridge is continued downwards and outwards, describing another forward convex curve (4, fig. 2), to the obtuse paroccipital angle. The whole occipital region is thus bounded above by a festooned arched ridge, formed by the sudden subsidence of that surface below the level of the upper surface of the cranium; the four festoons or curves being equal and divided by the supraoccipital convexity at the middle, by the exoccipital tuberosities (*t*, *t*) at the sides, and by the paroccipital angles (4) below. The depressions upon the surface so defined, together with the extraordinary extent of the concave posterior surface at the sides and below the occipital tubercle (fig. 4), indicate the mass of the muscles implanted into the back part of the skull, and the strength which must have been exerted to overcome the resistance, to which the nature of the food necessitated the application of the beak. The sides of the basisphenoid which form the base of the tympanic cavity extend outwards in the form of a rugged protuberance (*y*, fig. 4) which almost meets the tympanic process (8″) of the mastoid and grasps the upper and hinder condyle of the tympanic bone (28, fig. 3).

The alisphenoid which extends upwards and outwards from its anchylosis with the fore-part of the protuberance (*y*), is perforated or deeply notched by the foramen ovale (*tr*) immediately anterior to the inner glenoid cavity for the tympanic: its inner surface is impressed by the optic lobes (*l*, fig. 7): its outer surface is roughened by muscular attachments; and, as it bends upwards anterior to the mastoid, into the temporal fossa, its limits are obliterated by anchylosis with the mastoid, parietal and postfrontal which combine to form that fossa.

The sutures of the parietals, as of the other bones forming the cranial cavity, are obliterated; but a very remarkable transverse linear indentation, deepest on each side the middle line (see fig. 2), may, perhaps, indicate the place of the 'coronal' suture and the anterior limits of the parietals (7): it is, however, behind the relative position of the persistent coronal suture in the skull of the *Palapteryx* figured in pl. 39. fig. 5, and is nearer the supraoccipital ridge. There is a median rising where the sagittal suture originally ran; but the cranium of the Dodo shows a depression and minute foramen at this part. The temporal fossa is wider than in the Dodo: it is bounded above by a sharp ridge, well-defined by the sinking of the surface for the muscular attachment below the smooth level of the upper surface of the parietal and frontal (see fig. 1), and curving from the exoccipital tuberosity (*t*) forwards and downwards upon the long postfrontal (12). The major part of the temporal fossa is formed by the mastoid[1] (8)

[1] For the facts and arguments proving 8′ to be a process of the 'mastoid' and not of the 'squamosal' (*temporal*, Cuv.), see my work 'On the Archetype and Homologies of the Vertebrate Skeleton,' 8vo, pp. 32–35.

which sends downwards two processes, both having a ridge on their outer surface: the hinder or 'tympanic' process (8″, figs. 1 & 3) is the smallest, and bends in towards the tympanic tuberosity of the basisphenoid (*y*, fig. 3); the anterior or proper mastoid process (fig. 1, 8′) is an inch in length and a third of an inch in breadth, compressed from before backwards, grooved along its thicker inner border, and slightly bent forwards at its pointed extremity: a small part of the anterior margin coalesces with the long recurved postfrontal (12) circumscribing the temporal fossa externally, as in the Crocodiles. This coalescence does not take place in either *Otis* or *Didus*. The mastoid in *Otis* sends down a short tympanic process (fig. 9, 8″), as well as a long and rather slender mastoid process (8′): and the base of the mastoid has two articular cavities for the upper condyles of the tympanic bone. In *Didus* the outer side of the mastoid is convex, smooth, but with a slight oblique ridge: it overhangs the tympanic cavity, bending inwards, and sends a short compressed pointed mastoid process in front of the anterior articular cavity for the anterior superior condyle of the tympanic. The inner surface of the base and proper process of the mastoid affords three distinct articular surfaces for the tympanic bone: two of these are concave, are separated by a pneumatic foramen, and receive the proximal condyles of the tympanic; the third (*y″*, fig. 3), on the inner border of the mastoid process, is flat, and articulates with a well-defined elliptic surface (*f*, fig. 9. Pl. LIII.) on the outer side of the tympanic.

The tympanic cavity presents a large smooth transversely oblong depression (*d*, fig. 3) at its back part, bounded behind by the paroccipital ridge (4′) and the anterior external tubercle of that ridge, and bounded anteriorly by the tympanic process (8″) of the mastoid, which continues the curve of the anterior border of the depression which gave attachment to the tympanic membrane; on the inner side of this semicircular border are the orifices of the 'meatus internus' (*m*, fig. 3), those of the eustachian canals, and of pneumatic foramina communicating with the cellular structure of the walls of the tympanic cavity.

The presphenoid (9) is a deep compressed plate, with a rounded thickened border below, expanding as it advances as far as the prefrontal plate, where its anterior end has been broken off. The hinder parts of the palatines (20) where they coalesce with the vomer abut against the sides of the presphenoid.

The orbito-sphenoids (10) are indicated by the large optic foramina (*o p*), behind which are three smaller separate holes for the nerves and vessels of the orbit: external to these is a larger foramen, terminating a groove continued from the foramen ovale, and representing, therefore, probably the 'foramen rotundum' for the second or suborbital division of the trigeminal nerve: between this and the eustachian outlets there is a smaller foramen.

The orbital plates of the frontal (11′, fig. 3) are more remarkable for their transverse than their antero-posterior extent, and form at their meeting with the cranial plates (11, figs. 1 & 2) a broad overhanging supraorbital ridge, notched anteriorly behind a short rough antorbital process (*a*), and continued posteriorly into a long and broad compressed postfrontal (12) which descends and curves back to coalesce with the mastoid. The upper surface of the frontals presents two feeble convexities (fig. 2), slightly indicating the cerebral hemispheres; and anteriorly has coalesced with the prefrontals (14, fig. 5), the nasals (15, fig. 3) and the premaxillary (22'). The expanded upper surface of the coalesced prefrontals (fig. 5, 14) is covered by the naso-maxillary base of the upper bill (15, 22'), but is separated from it by a shallow interspace. In *Otis* the interorbital part of the frontals is deeply and widely excavated. In *Didus* the frontals are broad and convex, rising singularly above the cranial ends of the nasals and premaxillary, with which they also coalesce. The supraorbital plate presents a rough notch near the fore-part, where in *Dinornis* there is a shallow emargination. In *Dinornis* there is a shallow depression with vascular grooves at the outside of the base of the postfrontal, distinct from the temporal fossa, whereas in *Didus* the temporal fossa extends forwards above the postfrontal and forms there a reniform depression, either for a gland, or, what is less likely, for a coextension of the origin of the temporal muscle.

Of the vomer there is a portion of the narrow anterior end (13, fig. 3) which has coalesced with the palatines (20) and is grooved as usual above. Below the plate formed by the coalesced frontals, premaxillary and nasals, there is a distinct thin plate of bone formed by the coalesced prefrontals (14, fig. 5), which are continuous with the antorbital processes of the frontals (*a*, *a*), a deep notch indicating the limits of the two bones on each side. The prefrontals form two olfactory chambers, each of the size of a French-bean (fig. 5, 18, 18), smaller therefore, proportionally, than in the before-described crania of *Palapteryx*, and also more advanced in position. A single olfactory foramen opens into the back-part of each chamber, which also communicates by a larger lateral perforation (*b*, fig. 1) with the fore-part of the orbit. From each side of the coalesced prefrontals, an antero-posteriorly compressed angular process (14', figs. 1 & 5) extends outwards and downwards, bounding the orbit anteriorly: this process is perforated (*e*) at its base, and the olfactory chamber is continued upon a concavity at its fore-part (fig. 5): it does not answer to the position and connections of the lachrymal in other birds, but rather to that process which in many birds, the Bustard (fig. 8, 14'), Owls, *e. g.*, is developed from the fore-part of the interorbital septum, extends outwards and commonly coalesces with the lower end of the true lachrymal. The continuation of the presphenoid and orbitosphenoid with the prefrontals makes a complete bony interorbital septum in the *Dinornis*; but this is slightly swollen and cellular only at its anterior part, and not wholly, and to the enormous extent which characterises it in *Apteryx* and *Didus*. Although the nasals (15, fig. 2) have coalesced with the nasal process of the premaxillary (22') as well as with the frontals (11), their form and extent are indicated by linear grooves on both the upper surface of the frontals and the under surface of the nasal plate of the premaxillary (15', fig. 3): they are broad, convex and slightly raised at their base, where they are separated from each other by the premaxillary; converge and pass beneath the premaxillary (22) as they advance; meet and coalesce an inch and a half from their confluence with the frontals, and terminate in a point at the under surface of the nasal process of the premaxillary (22′, fig. 3) two inches and a quarter from the same part, which gives, therefore, the extreme length of the nasal bones: the breadth of their common coalesced base with the intermediate premaxillary is one inch five lines; that of each nasal is five lines.

The nasal process of the premaxillary extends over the depressed triangular space at the fore-part of the frontal (22′, figs. 2 & 5); and the posterior extremities of the nasals (15) have coextended backwards, where a slight linear groove indicates them to have converged and almost met behind the premaxillary. The nasal bones in *Otis* also converge where they overlap the prefrontal ('ethmoïde,' Cuv.) in order to join the frontal and include that end of the nasal process of the premaxillary. In *Didus* the nasals also anchylose with the frontal, where they are separated by the nasal process of the premaxillary, as indicated by the two longitudinal fissures, which commencing behind at two lines' distance from the upper border of the anchylosed base of the beak, gain that border at one inch nine lines' distance from the frontal, and thus indicate the proportions of the base of the beak formed by the anchylosed nasals. The fissure can also be traced, as in *Dinornis*, bending inwards upon the under surface of the nasal process of the premaxillary to about three inches from the frontal, when the fissure returns back inclining to the median line and meets its fellow there. All the outer part of the median stem of the beak of *Didus* defined by these linear furrows I regard as 'nasals.' The osseous base of the upper mandible of the *Dinornis* has been separated by fracture of the nasals and premaxillary near this point, and the fractured surface exposes the smooth upper surface of the coalesced prefrontals in the situation in which it appears in the *Struthionidæ* (14, fig. 5), and which, were the premaxillary to extend as far backwards as the nasals, would be covered by that bone, as in the *Dinornis*.

The nasal process, then, of the premaxillary commencing posteriorly, or terminating by a point where it is partly overlapped by the nasals, quickly expands, and in its turn begins to overlap the converging and contracting anterior ends of the nasals. This reciprocal overlapping must add much to the strength of the bony basis of the upper mandible. The upper surface of the premaxillary, at first flat or slightly concave, soon becomes convex, and gradually broader to the fore-part of the external nostrils, where it bends down on each side to form their anterior boundary, and joins what may be termed the body of the premaxillary (22, fig. 1): its breadth at this part is one inch one line, and the transverse curve or convexity of the bone here describes half a circle. From this part forwards the convexity begins to subside, and the bone very gradually contracts as it extends forwards to an inch and a half from the anterior margin of the nostrils; whence it preserves an equal breadth for the next three-fourths of an inch in advance, where part of the extremity has been broken away: the vertical diameter of the body of the premaxillary regularly decreases to this part; where, as it is reduced to one-sixth of a line, the fracture must have been close to the natural anterior termination of the bone; which, therefore, would seem to have ended by a broad truncated or slightly rounded border, and to have supported an upper bill, shaped like a cooper's adze; the whole upper bill being slightly and equably arched or curved downwards. The total length of the premaxillary to the thin fractured end is five inches two lines. In *Didus* the nasal branch of the premaxillary presents an elliptic transverse section where it quits the maxillary processes, diminishes in depth as it retrogrades, becoming depressed and broad where it rests upon and divides the nasals to anchylose with the frontal. Where the nasal and maxillary processes diverge, there is a deep groove externally terminating in a canal directed forwards into the rostral part or body of the premaxillary. This part is subincurved, pointed, rough, and with irregular vascular perforations, with a sharp inferior border on each side, and a more concave palatal surface than in *Dinornis*.

The palatal plate of the premaxillary in *Dinornis* extends one inch nine lines entire, from the fractured end to the anterior border of the palatal orifice of the bony nostrils: it is united to the upper plate by a strong median septum for about an inch and a half of its anterior extent: a loose cancellous tissue fills the lateral spaces between this septum and the lateral or bent-down plates: a rough low longitudinal ridge (*r*, fig. 1) extends along the outside of these plates, and defines them from the upper surface at the anterior part of the premaxillary. A well-defined rough alveolar border (*s s*, fig. 3) extends backwards on each side from the premaxillary upon the coalesced maxillaries (s', 21), and terminates by a slightly expanded portion below the anterior boundary of the external nostril (indicated by the dotted line at *n*, fig. 1). These alveolar borders form the sides of the shallow concavity on the palatine surface of the premaxillary. There are one or two vascular or nervous foramina on each side of this surface with grooves leading forwards from them; and there are numerous vascular and nervous foramina on the sides of the rostral part of the premaxillary (fig. 1, 22). Although the maxillaries have coalesced with the premaxillaries at one end and with the palatines at the other, the anterior flattened ends of the latter are defined by linear impressions, convex forwards, extending inwards from an angle of the thickened posterior end of the alveolar border (s'). The long and slender and almost straight palatines (20, figs. 1 & 3) are concave below, slightly so at their fore-part, but deepening as they pass backwards by the bending down of their outer and still more of their inner border: this part coalesces posteriorly with the vomer, which there unites together the two palatines, bounds with them the palatine nostril posteriorly, and is then continued forward in the middle line, dividing the back-part of the palatine nostril. Here the vomer contracts, but how it terminates anteriorly is not shown, the anterior end being broken off; it is grooved above where it supported the cartilaginous nasal septum: ossification has extended a little way into this septum from the middle of the under surface of the nasal process of the premaxillary (15′, fig. 3). The narrow alveolar process of the maxillary, continued backwards outside the fore-part of the palatine, has coalesced with a slender styliform malar, as the fractured surface (26, fig. 1) demonstrates.

In *Didus* the palatines arch outwards from their posterior attachments, are broad and smooth mesially, with a sharp crenate edge above; a thin, outwardly smooth convex ridge is directed outwards and forwards, and a more angular ridge is directed downwards, and ends in an obtuse point; a groove divides this from the outer ridge. The upper and outer ridge extends to the maxillary; the lower ridge subsides before it reaches the maxillary. The palatines form the boundaries of the naso-palatine aperture, and approximate each other at both ends, but do not meet. There is a fossa at the outer part of each palatine, and near the back-part there is a rough concavity; the rest of the outer surface is convex lengthwise, concave vertically. The boundaries of the maxillary are more readily traceable in *Didus* than in *Dinornis*: it forms in *Didus* a compressed longitudinal plate of bone with thick rounded borders above and below, and almost touches its fellow, leaving a deep narrow chink between the nasal fossa above and the palate below, which is closed by the palatal membrane.

The middle wall uniting the nasal and palatal plates of the premaxillary in *Dinornis* terminates by a thick concave border one inch five lines behind the anterior fractured end of the beak, and half an inch in front of the fore-part of the palatal nostril: this is a single long narrow median slit, bifid behind, from the entering vomer, which is above the plane of the palate; the length of the opening is one inch ten lines; its breadth at the middle part three lines. The external or facial nostrils are large, probably bounded behind by a slender nasal process ascending obliquely upwards and backwards, as indicated by its fractured base developed from the coalesced palatine and maxillary at *n′*, fig. 1: this process, perhaps, joined the broken part of the lateral process of the nasal at 15.

The tympanic bone (28, figs. 1 & 3, and figs. 8, 9 & 10, Pl. LIII.) presents no fewer than six articular surfaces: two at the upper smallest end (*e*, *e*), united by a linear strip of bone, which are convex and adapted to the two glenoid cavities on the under surface of the mastoid: one flat oval surface (*f*, fig. 9) on the outside below the neck of the condyles, for a corresponding surface on the back-part of the mastoid process: one small flat surface (*g*, fig. 10) on a short process from the inner side of the lower border of the orbital plate, for articulation with the pterygoid: a fifth deep hemispherical pit (*h*, fig. 9) on the outer border of the lower end of the bone, for the reception of the end of the squamosal, and a large articular surface (*i*, *i*, fig. 8) divided by a linear groove into two parts on a remarkably antero-posteriorly extended lower condyle for the joint of the lower jaw: the anterior division of this surface is transversely oblong, convex at its inner half, but concave transversely at its outer half; the posterior division is slightly convex. The orbital process (*k*) is a compressed subrhomboidal plate, convex externally, concave and rough for muscular attachment internally; its base extends from almost the whole anterior part of the shaft of the tympanic. It is broader and not so long as in the Apteryx, but more resembles the same process in the Emeu. The pneumatic foramen of the tympanic is in the hinder depression between the upper condyles. The chief peculiarity of this bone is the large size, backward extension, and upward curve of the broad inferior condyle (*i*, *i*).

In *Didus* the tympanic bone is subquadrate with the four angles produced, and the upper and hinder one bifurcate, forming the bifid condyle for the mastoid articular cups. The orbital process forming the anterior angle is compressed and truncate; the outer surface of the bone is smooth and convex vertically; the inner surface is traversed by a sharp concave ridge extending from the inner division of the upper condyle to the anterior part of the inner and lower condyle: the anterior division of the inner surface is concave; the posterior one is concave vertically, convex transversely. The antero-posterior extent of the condyle for the lower jaw is little, but greatest at its outer part where it rests upon the shallow reniform outer division of the concave articular part of the lower jaw: the inner more ridge-like part of the condyle sinks into a deeper transversely extended depression of the same articular concavity.

There is no trace of lower jaw belonging to the cranium above-described. The posterior portion of a left ramus (Pl. LIII. figs. 1, 2 & 3) has been articulated to a tympanic bone of at least double the size of the one in that cranium, and probably belongs to one of the larger species of *Dinornis*. The anterior portion of the lower jaw (Pl. LIV. figs. 6 & 7), though corresponding in size with the cranium of the *Dinornis casuarinus*, has belonged to a distinct genus of bird, of which the extremity of the premaxillary bone (Pl. LIV. figs. 1, 2 & 3, 22), conformable to that anterior end of the mandible, has been fortunately transmitted. There are also three portions of an almost entire lower jaw (Pl. LVI. figs. 7*s*, 12 & 13) belonging to a skull of smaller size than either of the above, and to a bird of a different genus. I shall, therefore, conclude the present section by some general remarks on the skull of which the characters of the constituent bones have been noticed above.

In the proportions of the cranial or cerebral to the facial or rostral parts, this skull offers the medium or normal character, such as is exemplified in the larger existing Struthious birds; but the beak is stronger, especially deeper, with more uniform breadth, and a greater curve; it is also broader and flatter at the extremity than even in the Ostrich, and much more so, therefore, than in the Rhea, Emeu or Cassowary: neither has it a median raised portion defined by longitudinal parallel grooves continued backwards to the external nostrils, as in those *Struthionidæ* and as also in the Apteryx. The cranial portion of the skull is remarkable for the great breadth and depth of its occipital region, and for the strength of the ridges, tuberosities and processes by which that region is defined. No known existing bird can compare with the *Dinornis* in this respect, or in the very singular downward development of the massive wedge-shaped basioccipito-sphenoidal part of the cranium (see fig. 4, Pl. 52). The cranium decreases in depth towards its anterior boundary, but comparatively little in breadth, until anterior to the postfrontals, from which the supraorbital ridges converge to the antorbital processes. The whole upper surface of the cranium (fig. 2) presents a slight and little-varied convexity, and is bounded by a hexagonal periphery; the two middle angles formed by the postfrontals (12) and the two posterior angles formed by the paroccipitals (4) being most produced, especially the latter, and each of the three sides bounded by them being largely excavated; the lateral ones by the temporal fossæ (8), from which the small mastoids project to join the postfrontals; and the posterior one by the festooned exoccipital arch (3, 3), below which the condyle (1) projects; the anterior border is also excavated or encroached upon by the naso-premaxillary base of the bill (15, 22'): the two antero-lateral or orbital borders (*a* to 12) are nearly straight.

No known bird presents such characters of the upper surface of the cranium: those of the lower surface (fig. 3), afforded by the occipito-sphenoidal wedge (5, 5'), by the abutment against its recurved borders of the thick paroccipital ridge (4'), and by the articulation or anchylosis of the stylohyal (38) with the mesial extremity of this ridge, form still more striking peculiarities of the *Dinornis*, or at least of the species under consideration. It is rare to see in a bird's cranium the roof of the orbit convex at its mesial half, pressed down, as it were, by the cerebral lobes above: this is the case with the *Dinornis* (fig. 3, 10, 11), where the convexities are divided from the presphenoid by a wide and moderately deep channel. The rough surface for the origin of the 'protractor tympanici' muscle (*orbito-quadratus*, V. d'A.) is remarkably well defined along the back-part of the orbit, extending from the alisphenoid to the under surface of the postfrontal; the fore-part of this long tract is indented by the fasciculi of the muscle, which was probably implanted into the large and deep depression on the inside of the orbitar process of the tympanic. The upper surface of the basioccipital presents two lateral depressions divided from each other by a median longitudinal ridge, and bounded laterally by precondyloid foramina.

The inner surface of the petrosal forms a smooth convex border around a deep fossa (16, fig. 7); below which is a slight depression with the minute foramina for the passage of the acoustic nerve (*ac*) to the labyrinth. The bottom of the petrosal pit, which is half an inch deep, and two lines wide at its mouth, appears to be naturally perforated by one or two minute foramina communicating with the pneumatic diploë. It gives the shape and degree of development of the lateral lobes of the cerebellum of *Dinornis*. The upper half of the petrosal border is bounded by a channel, narrow and deep at its middle part, terminating behind close to the foramen magnum and expanding in front into a wider depression for the optic lobes (*l*), in which both the foramen ovale (*tr*) and foramen rotundum are perforated: this depression is bounded above by the sharp tentorial ridge (*t*). The supraoccipital is deeply impressed by the cerebellum, and this fossa is defined above by a broader and blunted continuation of the lateral tentorial ridges: there is no osseous falx; only a slight median obtuse ridge where the frontal suture existed. The 'canalis caroticus' (*c*, fig. 4), commencing from the same external depression as the precondyloid canal (p), extends forwards and inwards through the pneumatic diploë at the base of the basisphenoid, until it gets below the 'sella,' when it bends upwards and inwards to terminate at the bottom of the deep but contracted pit, close by the orifice of the opposite canal, at the back part of the sella: the posterior boundary of that pit is continuous with that which bounds anteriorly the part of the presphenoid that supported the *chiasma nervorum opticorum*, at the sides of which are the large optic foramina (*op*, fig. 3). The olfactory foramen is single and distinct on each side (18, fig. 5).

On comparing the cranial part of the present skull with that described and figured in my second Memoir on the *Dinornis*[1], and assigned to *D. struthoïdes*, there is, besides the difference of size, much difference in the proportions and configuration of certain parts. The preservation of a portion of the smooth external inferior surface of the basisphenoid in the larger cranium demonstrates that that bone did not descend half so far below the occipital condyle as it does in the present cranium of the smaller species, which for convenience of reference I shall assign to the *Dinornis casuarinus*, with which it seems to agree in size. The distance from the occipital condyle to the back-part of the 'sella,' where the carotid canals terminate, is the same in both; but the canals commence, in the *struthoïdes*, by orifices quite distinct from the precondyloid foramina, which are on the same transverse plane as the condyle itself in the larger cranium: this is also broader and more depressed, and the tuberosities dividing the median from the lateral festoons of the supraoccipital crest are much nearer the middle line (pl. 38. fig. 1, *r r*). The outer articular cavity on the under surface of the mastoid for the tympanic is relatively much larger in the *struthoïdes*: the temporal fossa is deeper, and is separated from the occipital fossa by a wider space in the *struthoïdes*, not by a mere ridge as in *D. casuarinus*: the cerebral convexities are not indicated on the upper surface of the frontals in the *struthoïdes* as they are in *D. casuarinus*. The olfactory chambers (pl. 38. fig. 4, 18) are relatively larger and extend further back in the *struthoïdes*: there are obvious differences in the form and proportion of the paroccipital, mastoid, and postfrontal processes, but as these are more or less mutilated in the cranium assigned to *D. struthoïdes*, I forbear to dwell on them in the present comparison, the specific distinction being clearly established by the more important differences above-mentioned.

If we next compare with the skull of *Dinornis casuarinus* the smaller cranium referred to *Palapteryx dromioïdes*[2], we shall find in that specimen proof of the absence of the thick and broad inferior paroccipital ridge; the precondyloid foramina are raised to the level of the condyle, and are distinct from the carotid foramina. The longest diameter of the foramen ovale is transverse, not vertical as in *Dinornis casuarinus*. The antero-posterior extent of the temporal fossa is absolutely greater in the smaller cranium of *Pal. dromioïdes*. There is no groove in the line of the coronal suture, but a slight trans-

[1] Zoological Transactions, vol. iii. p. 308. pl. 38. figs. 1–4.

[2] Tom. cit. p. 311. pl. 39. figs. 4, 5 & 6.

verse depression nearer the supraoccipital ridge, and the cerebral convexities are less marked than in *Dinornis casuarinus*. The cranium of the *Pal. dromioïdes* figured in the former Memoir may have belonged to a younger individual, but the articular depressions at the fore-part of the frontals for the nasals show that the cranial extremities of those bones did not converge and approximate each other, as the corresponding extremities do which have coalesced with the frontal in the *Dinornis casuarinus*. The olfactory chambers also extend in *Pal. dromioïdes*, as in *Pal. struthoïdes*, further back between the orbits, and are absolutely larger than in the *Dinornis casuarinus*. In the *Pal. dromioïdes*, as in the larger cranium in pl. 38. loc. cit., there is but one large deep oblong articular cavity for the tympanic, instead of the two small subcircular cups as in the *Dinornis casuarinus*, involving therefore a corresponding difference in the tympanic bone, which must have presented a single proximal condyle as in the Ostrich and Emeu, instead of a double one as in the *Dinornis casuarinus*. This indicates the larger cranium (tom. cit. pl. 38. figs. 1—4) to belong to the same genus as the smaller one (pl. 39. figs. 4—6), viz. *Palapteryx*, and I propose therefore, with regard to the crania of the great birds from the soil of New Zealand, to restrict at present the term *Dinornis* to those which agree in generic characters with that here referred to *Dinornis casuarinus*.

Cranial characters of the genus Palapteryx.

A less-mutilated cranium of a *Palapteryx* (Pl. LV. figs. 1—3), transmitted by the Rev. William Cotton, M.A., from Wairoa in the North Island, of equal size with that referred to *Pal. dromioïdes* (pl. 39. fig. 5), but with larger (broader) olfactory chambers, smaller orbits, and a more contracted occipital foramen, shows the same minor development of the basioccipital (1′) and basisphenoid (5) downwards in comparison with that in *Dinornis* proper; the same higher position and independence of the precondyloid foramina (*p*), the same large and single oblong tympanic articular cavity (*y*, fig. 3. Pl. LV.) beneath the mastoid, and the same suppression of the broad lower paroccipital ridges. The under surface of the basisphenoid in this specimen is entire, and forms a square horizontal platform (5, fig. 3); the posterior angles consisting of hemispheroid protuberances (1″), and the anterior ones of short thick 'pterygoid' processes (5′), which are wanting in the skull referred to *Dinornis casuarinus*. The carotid canals (*c*) groove the sides of this platform, before they penetrate it. The temporal (6, figs. 1 & 3) and occipital (3) depressions are not so close to one another; are not divided by a mere ridge as in *Pal. dromioïdes*, but by a flat tract, as in *Pal. struthoïdes*; and the fore-part of the frontals thin off to an edge, which is not notched for the nasals, as in *Pal. dromioïdes*; but this latter may be a difference due to the age of the individual.

In a specimen of a mutilated cranium (Pl. LV. figs. 4 & 5), also sent to me by the Rev. William Cotton, M.A., from the North Island of New Zealand, which equals in size that of the *Dinornis casuarinus*, but which, from the minor degree of descent of the basioccipital, the position of the precondyloid foramina (*p*), the size and form of the single tympanic articular cavities of the mastoid, and the large development of the olfactory chambers, is referable to *Palapteryx*, one postfrontal, the left, is fortunately entire, and yields another mark of difference from the cranial structure of *Dinornis* proper, viz. the non-union of the postfrontal (12) with the mastoid (8). The postfrontal is a large triangular process, depressed, standing outwards, with a slight curve downwards and backwards, having the upper surface divided into a frontal and temporal facet, and the under surface deeply excavated at the base of the process (fig. 5, 12).

In a more mutilated cranium of apparently the same species of *Palapteryx* (Pl. LV. fig. 6), the form and proportions of the cerebral lobes and cerebellum are well shown, by the projection of the inner table of the cranium into the cellular diploë.

Skull of Palapteryx geranoïdes (?).

The second almost entire cranium in Mr. Mantell's rich and instructive collection (Pl. LIV.) agrees with those assigned to *Palapteryx* in all the characters by which they differ from the cranium assumed to belong to *Dinornis* (Pl. LII.); viz. in the minor descent of the basioccipital (1, 1″, fig. 4), the square platform of the basisphenoid (5, fig. 3), the higher position of the precondyloid holes (*p*, fig. 4) and their separation from the carotid holes (*c*), the minor development of the paroccipitals (4), the major development of the mastoids (8) and olfactory chambers (18, fig. 3), and especially in the large and single oblong depression (*y*, fig. 3) beneath the mastoid for the single superior condyle of the tympanic. The occipital condyle (figs. 2 & 4, 1′) forms the lower half of a hemisphere, but is not notched above and reniform as in the Dodo. The occipital foramen (*o*) is subcircular, broadest transversely. The descending basioccipital is impressed by a pit, divided by a median ridge, and bounded below by the straight posterior border of the basisphenoidal platform, the ends or angles of which are smooth round tuberosities (1″, figs. 3 & 4). The precondyloid foramina (*p*) are proportionally larger than in *Dinornis*, and on the same transverse line as the condyle. The descent of the basioccipital is somewhat less in *Didus*, but it also expands into two thick obtuse processes from which muscles pass to the inwardly bent angles of the lower jaw. Internal to these processes (3, 3), in *Didus*, are two short tubercles. The paroccipital processes (4) are semicircular plates, compressed from before backwards, divided by a notch from the basioccipital tubercles, in which notch is situated the entry to the carotid canal (*c*). The supraoccipital region is less bent forwards than in *Dinornis*, and is divided into two by a marked median vertical ridge: the subdivision of the halves is very slightly indicated by the bending down of the supraoccipital ridge midway between the median ridge and the paroccipitals (4, 4), but the tuberosities are much less strongly marked than in *Dinornis*.

The basisphenoidal platform (5, fig. 3) has a small perforation at its middle: the anterior angles are formed by the short thick outstanding pterygoid processes (5′), with flat oblique articular surfaces for the abutment of the true pterygoids.

The presphenoidal rostrum (9, broken away here) is continued straight from the fore-part of the platform, of which no transverse ridge defines, as in *Dinornis*, the anterior limits. The alisphenoid (6, fig. 1) forms, as usual, the anterior irregular wall of the tympanic cavity, is perforated by the foramen ovale (*tr*, fig. 3), and ascends to meet the parietal in the temporal fossa. The parietals (7, figs. 1 & 2) are very broad and flat; more feebly impressed by transverse grooves than in *Dinornis*. The base of the mastoid (8) stands well out, and the three-sided pointed process descends vertically from a ridge which crosses its base, and which bends down at a right angle upon the fore-part of the mastoid (8, fig. 1). The inner side of the process is excavated by the outer and fore-part of the tympanic articular cavity (*y*, fig. 3). A smooth tract, three lines broad, of the upper surface of the cranium divides the occipital (3, 4) from the temporal fossa (6, fig. 2), as in the large *Palapteryx struthoïdes* (pl. 38. fig. 3). Two very slight convexities on the frontals indicate the cerebral hemispheres. The postfrontals (12) arch downwards, are slightly impressed behind their base by the temporal fossæ, are more slender in proportion to their length than in the cranium of the *Palapteryx* figured in Pl. LV. fig. 4, 12, and have a short groove on the under side of their base: they terminate freely at a distance from the mastoids (8).

The frontals (Pl. LIV. 11, 11) are continued further forwards than in *Dinornis*, to form, with the prefrontals with which they coalesce, the roof of the capacious olfactory chambers (18, 18, fig. 3). The antorbital processes (fig. 1, *a*) bend down, and are longer and more slender than in *Dinornis*: they are impressed beneath by a smooth articular surface for the lachrymals. The anterior border of the frontals between these two processes, where it has coalesced with the nasal and nasal plate of the premaxillary, forms a plate of bone above, and is distinctly traceable from the coalesced prefrontals, though these are in contact with the overarching plate and not separated from it as in the *Dinornis*. Feeble depressions indicate the form and extent of the nasals and premaxillaries that are confluent with the frontal; but the broken edge is thinner as well as narrower, indicative of a less powerful bill than in *Dinornis*.

The median coalesced vertical plates of the prefrontals have been absorbed or unossified at the middle line or septum of the cranial olfactory chambers: but they expand above into broad plates (14, figs. 1 & 3) overarching those chambers. These together form an ovate cavity (18, 18) at the under and fore-part of the cranium, partially divided transversely and with the great end or division anterior, one inch four lines in length and eleven lines in greatest breadth. Each olfactory nerve appears to have entered its compartment of the cavity by one large and several small foramina, which pierce the hind and upper wall, and leave fine radiating grooves there. There are traces of the same foramina and radiating grooves in the other crania of *Palapteryx*, but the large round single (rhinencephalic) depression and foramen leading to the perforated and grooved plate are most obvious in the large specimen referred to *Pal. struthioïdes* (Pl. XXXVIII. fig. 4). In the cranium of the *Palapteryx* next in size (Pl. LV. fig. 5), the olfactory chambers are broader behind than in the present specimen and have not the transverse ridge: the frontal (fig. 6, 11) is broader and flatter between the antorbital processes, and the lachrymal surfaces beneath these lead to foramina which pierce the supraorbital ridge: the temporal depressions (fig. 4, 8, 12) are relatively larger, and are traversed by a subvertical ridge, which is but feebly indicated in Pl. LIV. fig. 1; which differences, with others before pointed out, indicate the specific distinctions of the birds to which these nearly equal-sized crania belonged. The under surface of a large portion of the frontals, with the coalesced upper prefrontal plates of *Palapteryx geranoïdes* (Pl. LIII. fig. 7), shows the median longitudinal ridge for the attachment of the falx, a depression on each side (11) indicative of a median longitudinal rising of the cerebral hemisphere, and a second parallel impression (7) indicative of an outer and more general prominence of the hemisphere.

Two genera of large birds, as distinct from each other as from the *Dinornis*, are represented by portions of the upper and lower jaws, in Mr. Walter Mantell's collection. The beak which accords in size with the cranium of *Palapteryx* above-described, is indicated by the anterior extremity of the premaxillary (Pl. LIV. figs. 1, 2, 3, 5, 22), and by the symphysis and part of both rami of the mandible (figs. 1 *sg*, 6 & 7). The end of the premaxillary best accords in form and structure with that characteristic part in the large existing *Struthionidæ*, by the close approximation of the external bony nostrils (*n*, fig. 1) to its extremity, and by the nasal groove (*ng*) continued thither from the anterior border of the nostril, on each side. But amongst these it most resembles the Emeu (tom. cit. Pl. XXXIX. fig. 1) in the slenderness of the nasal process (22′, figs. 1 & 2), in the angle at which it rises from the broad and flat maxillary portions (22), and especially in the palatal plate (22″) formed by the union of those portions below the nasal process: but the nasal process, in *Palapteryx*, is broader and apparently shorter than in the Emeu, as it sooner becomes flattened after leaving the maxillary portion. The tip of the premaxillary is partially fractured; but from the more perfect extremity of the lower jaw (figs. 6 & 7), it seems to have been more obtuse than in the Emeu, and in this respect more like the Ostrich. The under or palatal surface (22″, fig. 3) differs from that both of the Ostrich and the Emeu in having a distinct rough multi-perforated alveolar border (*s s*), broader than in the *Dinornis*, and grooved along its outer part, but divided by a slight convex rising or 'bead' from the gentle concavity of the palatal surface, which is divided into two parts by a low narrow median ridge with a linear impression: the outer border of the alveolar tract is as sharp and even as in the Emeu. The anterior border of the palatal aperture of the nostrils shows this to have been much wider than in the Emeu, where it is a mere linear slit: it is about an inch from the extremity of the premaxillary. A ridge commencing from the upper part of the alveolar border, opposite the anterior border of the palatal aperture, emerges forwards and upwards towards its fellow on the opposite side, gains the under surface of the nasal process, and again diverging, terminates in its outer margin, defining sharply in its course the anterior boundary of the outer nostril (*n*, fig. 5), in front of which the smooth surface expands to the rough perforated bone forming the extremity of the premaxillary: the root of the nasal process is still defined upon this part by lateral grooves (*n g*), as in the Emeu, the Rhea, the Ostrich, and also the Apteryx, notwithstanding the unusual prolongation of the body or rostral part of the premaxillary in that bird. The back part of the nasal process is grooved between the two curved ridges; the under part of the process presents a median ridge (22′, fig. 5).

The corresponding extremity of the under jaw differs in a greater degree from that in the existing *Struthionidæ*, the symphysis being concave above from side to side instead of flat (fig. 7). This specimen agrees so closely in size, in colour, in the character of the perforations, and especially by the distinct alveolar edge and inferior parallel symphysial grooves, with the corresponding extremity of the premaxillary bone (22, figs. 2 & 3), that I am led to believe it to have formed part of the same beak. The outer part of the alveolar border, moreover, is convex, adapted to the groove in that part of the upper jaw, and the inner part is grooved and reciprocally adapted to the convex inner border of the alveolar groove above. Notwithstanding the difference in the depth and semicylindrical curve of the symphysis of *Palapteryx* from that of the existing *Struthionidæ*, it presents on its under part the two characteristic parallel longitudinal grooves (*sg*, fig. 6) which mark out the median prominence on that part. The line indicative of the harmonia of the splenial piece is obvious on the under margin of each ramus. The rami are thicker and deeper anteriorly (fig. 1 *sg*) than in the Ostrich (Pl. LIII. fig. 5). The grooved alveolar border terminates behind, two inches and a half from the end of the jaw: the outer side of the jaw presents a deep vascular groove beneath that border, which ends in foramina at the beginning of the coarsely perforated symphysial extremity: the contour of the alveolar border is gently convex, and the under border of the same part of the ramus correspondingly concave; behind this part the upper border becomes concave and the lower one convex, the whole ramus of the jaw having a sigmoid flexure: the upper border behind the alveolar portion becomes rounded and thinner, while the lower border below increases in thickness. The longest portion of the ramus reaches nearly three inches and a half from the end of the symphysis: there is a large groove and perforation close to the broken end on the outer side: the lower jaw was probably from five inches to five inches and a half in length, and was shorter in proportion to its breadth and depth than in the Ostrich, or perhaps the Emeu, if we may judge from the extent of the alveolar ridge, and from the early flattening of the nasal process of the premaxillary. The angle of divergence of the mandibular rami is the same as in the Emeu.

From the above-described characters of the cranium and portions of jaws figured in

Pl. LIV., good and sufficient evidence it is presumed has been adduced of the former existence in New Zealand of a large Struthious bird, more nearly allied to the existing *Struthionidæ* than to the *Dinornis*, and agreeing in the characters of the cranium and beak more with the genus *Dromaius* than with the genus *Apteryx*. The particulars in which the cranium (Pl. LIV. figs. 1—4) resembles that of the Emeu (Pl. XXXIX. figs. 1 & 2), as *e.g.* the broad flat under surface of the basisphenoid (5), the pterygoid processes from its fore-part (5'), the semicircular paroccipital plates (4), the single articular cavity for the tympanic (*y*), the size, form and independence of the mastoid and postfrontal processes, &c., are corroborative proofs of the accuracy of the ascription of the above-described struthioid premaxillary and mandibular bones (Pl. LIV. figs. 1, 2 & 3, 22, 6 & 7) to that cranium. At the same time the cranium, by its greater breadth behind and minor depth, its vertical foramen magnum and prominent occipital condyle, the inferior position of the basisphenoid platform, the marked angle which it forms with the almost vertical basi-occipital, and the shorter pterygoid processes, concurs with the beak in differential characters establishing the generic distinction of the great New Zealand bird to which it belonged.

As the characters which induced me in the former Memoir (p. 327) to separate those bones of the extremities that by their more slender proportions approximated the *Struthionidæ*, and by the indication of a small back-toe the *Apteryx* more especially, from others of corresponding size but of more robust proportions, and devoid of the back-toe, and to assign to the genus more nearly allied to the struthious *Apteryx* the name of *Palapteryx*, and to restrict the term *Dinornis* to the other specimens,—so the corresponding characters which indicate in the first of the skulls above-described a deviation from the struthious type, and in the second an approximation thereto, clearly indicate the propriety of assigning the one to the genus *Dinornis*, and the other to the genus *Palăpteryx*. Time, and future more fortunate discoveries of the skull and other parts of the skeleton so associated as to yield reasonable proof of having belonged to the same bird, may give the requisite confirmation or rectification of these partial and tentative restorations.

Lower jaw of a large Dinornis *or* Palapteryx.

On similar grounds to those that have induced me to combine the cranial and rostral portions of the skull of the two genera of gigantic birds figured in Plates LII. & LIV., I have been led to associate together the detached portions of cranium and upper and lower jaws figured in Pl. LVI. fig. 7, which establish a third genus of apparently extinct New Zealand bird. But before proceeding to describe these singular and interesting remains, I must notice a remarkable fragment of a lower jaw of some species of *Dinornis* or *Palapteryx* much exceeding in size those of which the crania have been described.

This specimen (Pl. LIII. figs. 1, 2 & 3) consists of the articular end of a ramus of the lower jaw, the proportions of which, as compared with that of the Ostrich, may be inferred from the lower jaw of that bird placed by the side of that of the fossil in Pl. LIII. fig. 4. The articular end presents a large triangular expansion, with a deep irregular excavation above: in this excavation are two articular surfaces for the lower condyles of the tympanic, one (*x*) long, narrow and shallow, following the external border of the expansion; the other (*z*) shorter, broader and much deeper, crossing the inner side of the great concavity, describing a semicircle lengthwise, but flat or slightly convex crosswise, with a well-defined semicircular edge at its outer and anterior end. The hinder subvertical ridge of the expansion is less produced than in the Ostrich or Emeu; the outer articular surface extends to it in the fossil, but stops short in the Ostrich. The inner and lower angle forms a short obtuse process. The inner articular cavity in the Ostrich and Emeu is angular, not curved. The surangular and angular pieces are separated, in the present specimen, by a longitudinal vacuity reaching to the fractured end of the fossil (fig. 1); the outer side of the angular piece here shows the smooth depression for the lower piece of the bifurcate end of the dentary. The articular, angular and surangular pieces have coalesced.

Notwithstanding the superior size of this fragment of jaw to the corresponding part of the Ostrich, it seems not sufficiently large for the proportions of the gigantic species of *Dinornis*, and is more probably referable to the *Palapteryx ingens*.

Cranial characters of the genus Notornis.

The third genus of bird, for which I would suggest the name *Notornis*[1], is indicated by a nearly entire skull, giving, besides the characters of the cranium, the form of the beak and the position and size of the external nostrils (Pl. LVI. figs. 7—13).

The cranium is of the size of that of the large Maccaw, which I adduce for this comparison because it is one of the few existing birds with a broad sloping occiput and with backwardly bent paroccipitals, as in the present specimen; which, however, in the breadth and slope of the occiput more closely adheres to the type of the *Dinornis* and *Palapteryx*, having the plane of the foramen magnum (*o*, fig. 10) vertical, the prominent hemispheric condyle (1) projecting beyond it, the basioccipital (1, 1″) extending below it further down than in the Maccaw or Apteryx, but proportionally less than in *Palapteryx*. The cranium which presents the closest accordance with the one under consideration is that of the Purple Coot or Sultana (*Porphyrio*), with which, therefore, I shall more immediately compare the present fossil. The basisphenoidal surface (5, fig. 9) is flat, but pentangular as in *Porphyrio* (5, fig. 3), the anterior angle projecting below the base of the presphenoid (9); there are no pterygoid processes in either genus; a slender ridge (5′, fig. 9) is continued from each paroccipital to the lateral angles of the

[1] Gr. νότος south, ὄρνις bird.

platform; the posterior angles are hemispheric tubercles (1″) as in *Palapteryx*. The pre-condyloid holes (*p*, fig. 10) are nearer the carotid holes (*c*, fig. 9) than in *Palapteryx*, opening into the upper part of the same fossa. The occipital region inclines forwards as it rises, and is defined above and laterally by a strongly marked ridge (2, 3, fig. 10), which forms a slight angle above the base of the mastoid: the occipital surface is not divided by a median vertical ridge. In *Porphyrio* (figs. 1 & 4) the plane of the occipital foramen inclines from below upwards and backwards; that of the occipital surface is vertical; it is proportionally narrower than in *Notornis*.

The mastoid (8) gives off a short compressed angular tympanic plate (8, fig. 8). The fractured base (8′, fig. 9) of a process answering to that of the true mastoid process in other birds, and marked 8′ in the skull of the *Dinornis* (Pl. LII. fig. 1), comes off from the lower part of the temporal fossa more in advance of the process 8, and rather, as it would seem, from the alisphenoid than the true mastoid. The same peculiarity is repeated in the cranium of the *Porphyrio* (Pl. LVI. fig. 1, 8′). The articular surface for the tympanic is divided, as in *Dinornis* proper, into two subcircular cavities (*y*, *y*′, fig. 9) by a pneumatic foramen. The parietal region (7, fig. 8) is singularly flat: the temporal fossæ (between 8 and 12) unusually long; well-defined by the ridge extending from the paroccipital to the postfrontal: this process (fig. 7, 12) is short, obtuse, directed downwards and backwards; broader in *Notornis* than in *Porphyrio*. The temporal fossa is equably divided by an intermuscular ridge (8′, fig. 7) probably continued upon a mastoid process as in *Porphyrio* (fig. 1, 8′). The whole inferior border of the temporal fossa is produced as a vertical ridge below the level of the adjoining basis cranii in both *Notornis* and *Porphyrio*, which gives a very peculiar character to this part of the cranium. This ridge (fig. 9, 8′) bounds the outer side of a large and well-defined muscular impression with intermuscular ridges extending from the anterior tympanic articulation (*y*) to the fore-part of the base of the postfrontal (12). There is a similar muscular depression in the *Porphyrio*: in the Maccaw it is much shorter, by reason of the less antero-posterior extent of the temporal fossa. The fore-part of the frontal, which extends beyond the cerebral cavity, and appears to have anchylosed with the base of the upper beak, has been broken away, exposing a fine pneumatic diploë (*dl*, fig. 8), and the olfactory outlet (*ol*, fig. 11), which appears to have been common to both nerves; but there is no trace of olfactory chamber at this part, as in *Palapteryx*.

The chief singularity of the cranium, so mutilated, but with the cerebral cavity entire, is its regular four-sided figure; the breadth of the fractured anterior part being almost that of the occipital region, and the extent of the sides being scarcely more than that of the front and back part. This character is very striking as we look upon the almost flat basis cranii (fig. 9), and is well-marked when the cranium is viewed from above (fig. 8), where a smaller flat square platform (7, 11) is defined by the occipital and temporal ridges in the middle of the large square; of which smaller square the anterior boundary is wanting, the platform here sloping gradually down to the base of the bill.

It is in this part of the skull that the *Porphyrio* (fig. 2) most departs from the character of the *Notornis*, the parieto-frontal region of the skull (7, 11) being convex and oblong. There are no cerebral or hemispheric convexities in *Notornis*. The relative extent of the temporal fossa is greater than in any known bird; the *Porphyrio* makes the nearest approach to it. The optic foramina are blended together, and the orbits are remarkably small and ill-defined. The petrosal is proportionally large in the interior of the skull; its central depression (16, fig. 11) is narrow and deep, with an entry of an hour-glass form. The sinus or groove which extends round its fore-part is narrow and deep: the foramen ovale is large: the under surface of the frontals, at their coronal confluence, is traversed by a median longitudinal groove, with a parallel broader depression on each side of it. The presphenoid has been of considerable depth; but its fore-part, together with the prefrontals, is broken away.

The base of the upper beak, which was attached to the frontals, is a straight border (15, 22', figs. 8 & 9) ten lines in extent and half a line thick: the middle two-fourths is formed by the nasal process of the premaxillary (22'), a short linear fissure dividing this on each side from the true nasals (15), the outer angles of which bend up. The bony base of the beak of *Porphyrio* presents a similar conformation (fig. 2, 15, 22'). The bony upper beak of *Notornis* is a long, inequilateral triangle, subcompressed, very slightly curved down; with a quadrate oblique base (fig. 12), a smooth convex upper border, very gradually narrowing to the blunt-pointed apex; the sides almost vertical; the under (palatal) surface (22'', fig. 9) deeply grooved along the middle of its anterior half as far as this extends in the fossil; the groove deepening and widening to the single median palatal opening (*pl*) of the nostrils. The alveolar borders are entire and sharp, with their inner sides slightly and obliquely grooved. In *Porphyrio* the palatal surface of the premaxillary presents a narrow ridge along the middle of its anterior half; and the excavated surface on each side of this is continued to the sharp alveolar border. The external nostrils in both *Notornis* and *Porphyrio* are of a slender ovate form, with the great end forwards and the long axis parallel with the upper slope of the beak; they are perforated on each side near the base, quite in the posterior half, of the upper beak. They open into a common excavation at the base of this part, the lateral walls of which in *Notornis* are thin above and thick and cellular below, with two openings at the back of this cellular part leading into it (fig. 12). A thin transverse plate of bone (22', fig. 12) rises from the lower and fore-part of the external nostrils, spans across the palatal nostril, and ascending perpendicularly with a slight curve backwards, closes the fore-part of the nasal chamber; there is no trace of bony septum dividing this chamber: the under surface of the nasal plate of the premaxillary is almost flat and smooth. The repetition of all the essential characters of this bony upper beak in the *Porphyrio* (figs. 1, 2, 3) is so close, though diminished to the scale of one-half, as to preclude the necessity of reference to any other form of bird in the elucidation of the affinities of *Notornis*. Yet the form, so magnified, is so novel and unexpected, that

I may be excused for occupying a few moments in pointing out the differences observable in those birds that, resembling the *Notornis* in size, come nearest to it in the structure of the beak.

The depth, the degree of compression and the upper convexity of the strong bony basis of the upper bill of *Notornis*, with its almost basal perforation by the nostrils, remind us of some of the characters of the great Maccaw's beak; but, besides the absence of the terminal hook, the superior size of the nostrils, in *Notornis*, the absence of the bony septum narium, and the grooved and perforated palatal surface of the premaxillary, are essential deviations from the parrot-type of beak. It approaches more in shape to the upper beak of the Raven, but it is less curved, deeper and more compressed, and the sides are more vertical; the nostrils are also smaller, and the palatine surface of the Raven's premaxillary is entire, gently hollowed out, with a median ridge instead of a groove. The *Porphyrio* in every particular save size much more closely repeats the characters of the skull of *Notornis*; and the affinity is equally decisively marked in the form and structure of the lower jaw. Of this part of the *Notornis*, the entire ramus of the right side and the whole of the symphysis have been fortunately preserved. The posterior articular expansion presents above an irregular transverse subrhomboidal cavity, with a narrow and long articular surface (*x*, fig. 13) extending along the outer and hinder border; and the shorter and broader articular surface (*z*) at the fore-part of the deep central depression. The inner angle rises almost vertically: it has a small pneumatic foramen (*pn*): the back part of the enlargement presents an almost flat, irregular, triangular, slightly concave vertical surface; the lower angle (30) curves downwards and forwards below the lower border of the ramus. The surangular (29', fig. 7) supports a low coronoid process, whose base reaches from the articular enlargement to near the beginning of the sharp alveolar border: its truncated summit has two small depressions on its outer side; they are deeper parts of a more extensive external muscular impression, bounded below by a line reaching nearly to the lower border of the ramus. This border (fig. 12) is smooth, convex, and of uniform thickness; it describes a gentle sigmoid curve, convex on leaving the deflected angle, concave where it joins the symphysis (*s*, fig. 7). The coronoid region has three perforations; the posterior one (*w*) is a small vertical oval, the anterior (*u*) is a longer longitudinal ellipse, and immediately behind this is a linear fissure, which marks part of the lower boundary of the surangular (29'). All the elements and both rami of the jaw have coalesced.

The upper border of the ramus is convex, and a little thickened between the coronoid and the beginning of the sharp alveolar ridge: this is continued to the point of the symphysis, *s s*, which is more than one-third the length of the jaw; and the alveolar ridges, in gradually converging to the almost pointed termination of the mandible, describe the gentlest curves convex upwards and concave outwards. The lower border of the symphysis (fig. 12, *s s*) is smooth and convex from side to side, and extends in a straight line from the back part of the symphysis obliquely upwards to the apical extremity of the mandible: the upper surface of the symphysis (fig. 13, *s*) is deeply and almost angularly excavated. The inner surface of the free portions of the rami is smooth and gently concave, with a semicircular ridge extending from the anterior to the posterior subcoronoid perforation. If the foregoing characters, of which the details will be excused from the rarity of their subject, be compared with those of the lower jaw of *Porphyrio* represented in figs. 1, 5, 6, Pl. LVI., the correspondence will be found almost perfect: the lower jaw of *Porphyrio*, however, is not a pneumatic bone and has no perforation for the admission of air.

It is in the comparison of the lower jaw of the *Notornis* that the difference from the Maccaw and the Raven, to which a passing reference was made in the description of the upper jaw, is most strikingly seen. The mandible of the Raven is as much too shallow as that of the Maccaw is too deep; and in neither are the characters of the angle of the jaw or the perforations repeated. And I may briefly state, that after passing in review all the skulls and mandibles of the birds in the Hunterian and some other Metropolitan collections, it is only in the *Rallidæ* or the family of the Coots that I have met with those essential marks of correspondence which have led to the determination of the affinities of the bird to which the third remarkable fossil cranium in Mr. Mantell's collection has belonged.

Besides a species of true *Porphyrio* (*P. melanotus*, Gould) in New Zealand, there exists in that island a peculiar and highly interesting form of the *Rallidæ* in which the wings, although not so rudimentary as in the Apteryx, are nevertheless so restricted in their development as to be useless for the purposes of flight. This bird is the type of the genus *Brachypteryx*,—a genus as characteristic of New Zealand, as is the *Apteryx* itself. In the lower jaw of the *Brachypteryx* we have the same form of the angular and articular enlargement, with the vertical triangular posterior facet, the short deflected and precurved angle, the posterior smaller and fuller oval perforation (*w*), and the anterior fissure of the coronoid part of the jaw, but not the opening (*u*): the symphysis is shorter, but the rounded under-part ascends obliquely straight to the pointed termination of the mandible. There is the same kind of agreement in the upper jaw: the solid or rostral part of which, anterior to the nostril, has the same essential form, viz. a very slight and equable downward curve, gradually contracting to the point, which is rounded off, while the sides are almost vertical. The palatine surface is deeply excavated, but the lateral grooves are not defined as in *Notornis*. The differences between the beak of this genus or of *Porphyrio* and that of *Brachypteryx* are those of proportion. The whole beak is longer and more slender relatively to the cranium in *Brachypteryx*; and this length is gained by the elongation of the nasal part of the beak, or that which is perforated by the external nostrils, and of the part between the coronoid portion and the symphysis in the lower mandible.

One may also follow minor traces of resemblance in the cranial part of the skull of *Brachypteryx*, e. g. in the flat square formed by all that part of the basis cranii included between the postfrontals and paroccipitals; in the proportions of the postfrontal and mastoid; in the orbits scarcely at all impressing the under and fore-part of the cranium; and in the relative extent of the temporal fossæ, although the lower boundary of these is not developed into a vertical ridge as in *Porphyrio*. But, on the other hand, *Brachypteryx* more resembles *Notornis* in the relative breadth of the occipital region than *Porphyrio* does. In the comparatively small *Brachypteryx* and *Porphyrio*, in which, as in all small birds, the cerebral hemispheres, as requiring a certain bulk for their functions, do not decrease in proportion to the general bulk of the body[1], the upper surface of the cranium is raised by the hemispheres beneath into a smooth convexity. The chief characters of the skull by which *Porphyrio* and *Brachypteryx* resemble *Notornis*, are participated in by the European and African *Rallidæ*; but in the forms and proportions of the upper and lower bones of the beak, the *Porphyrio* of all existing birds makes the nearest approach to *Notornis*.

Upper mandible of Nestor.

The fourth genus of bird indicated by portions of the skull in Mr. Walter Mantell's collection is plainly referable to the family of Parrots (*Psittacidæ*), and particularly to the genus *Nestor*. The bony portion of the upper beak (Pl. LIII. figs. 11, 12, 13),—the only part of the skull preserved,—by its deep, subcompressed, curved and pointed

[1] "The brain in birds, as in reptiles, bears a proportion rather to the heart than to the whole body. In the Humming-bird it is as 1 to 12; in the Ostrich as 1 to 3000: the medium or average proportions of the brain to the body of birds, is computed by M. Leuret to be as 1 to 212.

"The hemispheres consist chiefly, as Cuvier has stated, of a mass of cerebral matter, which, by its intermixture of grey and white matter, resembles the corpus striatum.

"The cerebrum has been thought, from its large proportionate size in some of the lightest and most diminutive of the feathered tribe, to be better developed in them than in the Elephant, the Orang, or even in Man himself. But the supraventricular mass of cerebral matter, which constitutes the actual characteristic superiority of cerebral organization in the brain of Mammalia, is in birds not better developed than in reptiles."

"The lateral ventricles are covered laterally, superiorly, posteriorly by the thinnest film of medullary matter.

"Space seems to be almost or altogether denied for the location of the phrenological organs, to which the very striking and various psychological manifestations and instincts of the Bird might be assigned."—*Report of Prof. Owen's Hunterian Lectures on the Nervous System*, '*Medical Times*,' *October 29th*, 1842.

"Thus, it is well known that the general statement, that the brain of Man is larger in proportion to the entire weight of his body, has been disproved by the fact that a higher proportion is presented by several small birds and rodents. But if the statement had been made that the *cerebrum* of Man is heavier in proportion to the weight of his body than that of any other animal, we apprehend that it would have been strictly correct. For the encephalon of birds is still made up chiefly of the chain of ganglia we have described, which attains, we believe, its highest development relatively to the weight of the body in that class. On turning aside the cerebral hemispheres (which do not yet cover in the optic lobes) we find that they really form but a thin lamina, beneath which lies a series of large protuberances, which the study of their connections at once discovers to consist of the corpora striata, thalami optici and optic ganglia. If these were weighed, exclusively of the cerebrum proper and cerebellum, we are assured that they would bear a larger proportion to the whole body of the smaller birds than they would in any other class."—*Carpenter's Article XIII. of the* '*British and Foreign Medical Review*,' 1846, p. 501.

form, its seeming solidity, pierced by small subcircular nostrils (*n*) close to its base, and impressed by the transverse articular fossæ behind the palatine plate of the premaxillaries for the true palatine bones, attests the family character; whilst the proportional length as compared with the depth, the narrow upper surface to where it suddenly expands above the nostrils to join the cranium, the oblique depression on the outer surface of the beak leading to the external nostril, the very narrow elongated triangular palatal surface, with the median linear notch at its base,—all demonstrate that in this characteristic part of the skull, the New Zealand bird represented by it most resembled the genus *Nestor*, a singular nocturnal Parrot, at present only known as a denizen of that island; where it is represented by species not inferior in size to the one indicated by the bony portion of the upper beak. By the kindness of Mr. Gould I am enabled to give figures of the upper mandible (figs. 14, 15, 16) of the *Nestor hypopolius*.

Thus then it appears that the indications in my former Memoir (Part II.) of two genera with several species of terrestrial birds of large or gigantic size afforded by bones of the legs, discovered in New Zealand, is most fully and satisfactorily confirmed by the evidence of the subsequently received bones of the head and beak.

The form and structure of these characteristic parts in one of the specimens are so peculiar, that I am at present unable to refer the genus to any known natural family of birds. If I am correct in associating this form of head and beak (Pl. LII.) with those bones of the leg referred to the genus *Dinornis* as at present restricted, that genus, indeed, may be referred to the section of Cuvier's *Grallæ* which the great Naturalist has called '*Brevipennes*,' but which Vigors has sunk to a mere family of *Gallinæ*, which he called *Struthionidæ*, and which Illiger made the type of his distinct order *Cursores*: but the reference to that section or order must be understood to be made only by reason of the extraordinary development of the legs and the very restricted development of the wings, of the *Dinornis*: for neither the proportions of the metatarsi, the form of the pelvis, nor that of the beak as represented by the skull first described in the present Memoir, would indicate any very close or natural affinity with the existing brevipennate or struthious birds. With these the *Dinornis*, like the *Apteryx*, the *Brachypteryx* and the Dodo, agrees in the strength of leg and the weakness of wing, with the total abrogation of the power of flight: but these are by no means the characters of a natural order or family.

As regards the *Apteryx*, I have before shown that its elongated Ibis-like beak is essentially a modification of the struthious structure of that part, and both sternum and pelvis, as well as certain parts of its internal anatomy[1], concur in manifesting its true struthious affinities.

With respect to the Dodo, the idea entertained by Dr. Reinhardt[2] and by Mr.

[1] Zool. Trans. ii. p. 296.

[2] In a letter to Professor Sundevall, written, as the Doctor informs me, during the circumnavigatory voyage from which he has lately returned.

Gould[1], of its affinity to the *Columbidæ*, was supported by new arguments adduced by Mr. Strickland in his elaborate and interesting communications and lecture before the British Association at Oxford (June 1847), and will doubtless be further elucidated in the forthcoming work on the extinct flightless birds of the Mauritius and neighbouring Isles, which Mr. Strickland is about to publish in conjunction with Dr. Melville. It need cause no surprise, since there are strictly aquatic and marine forms of birds deprived, by a low development and special modification of the wings, of the power of flight, if we should detect in other natural groups of birds aberrant forms similarly debarred from what seems to be the characteristic field of locomotion of their class, to range which aery region by power of flight would seem to have been the special aim and end of all the remarkable modifications of structure by which Birds are distinguished from the other classes of vertebrate animals. I know not a more perplexing or suggestive problem in the series of seeming anomalies of Natural History than a bird that cannot fly.

Of what known natural group or family of birds the *Dinornis* with its adze-like beak and crocodilian cranium is an apterous modification, I am not at present enabled to express a decided opinion. The closer conformation of the pelvis of the *Dinornis* to that of the Bustard than to those of the true *Struthionidæ*, is pointed out in my Memoir of 1843[2]; and I may now add, that the Bustard—by the extension of the bony ridges from the paroccipital to the basisphenoid, by the ridge of the basisphenoid underhanging the notch of the eustachian outlets, by the presence of a tympanic process as well as a true mastoid process from the mastoid bone, by the division of the articular surface for the tympanic bone into two distinct cups, by the extent of the tympanic excavation behind these, and by the backward extension of the nasals and nasal process of the maxillary above the expanded upper plate of the coalesced prefrontals,—approaches nearer the *Dinornis* than does the *Apteryx* or any of the larger existing struthious birds. The Bustards, like the *Dinornis*, want the hind-toe. Were the large sternum described in my Memoir of 1846[3] certainly proved to belong to the genus *Dinornis*, as now restricted, it would, from its resemblance to that of the *Apteryx*, incline the scale of judgment towards its natural affinity to that genus and to the true *Struthionidæ*; but since the remains of the *Palapteryx ingens*, as well as those of *Dinornis gigas*, were discovered in the same turbary deposits, the sternum in question may with equal probability on that score, and now with more reason, from the discovery of a true struthious form of cranium among the remains of the great birds in New Zealand, be referred to the genus *Palapteryx*, represented by the bones of the extremities described in the former

[1] Birds of Australia, Part XXII. Description of the *Gnathodon strigirostris*: the bird, which its discoverer, Mr. Titian Peale, supposed to be allied to the Dodo, and proposed to name *Didunculus*, which was first described by Sir William Jardine under the name of *Gnathodon strigirostris*, and which Mr. Gould regards as being most nearly allied to the family of Pigeons, *Columbidæ*.

[2] Zool. Trans. iii. pp. 255, 257.

[3] Zool. Trans. iii. p. 316.

Memoir, and by such second form of cranium and beak described in the present Memoir.

That mere shortness of wing and length of leg are no true characters of a natural group, even when the legs are adapted for swift course on dry land, is evinced by the singular short-winged Rail (*Brachypteryx*) at present existing in New Zealand, and which was probably manifested on a larger scale by the allied genus *Notornis*, which unquestionably belongs to the *Rallidæ* rather than to the *Struthionidæ*. I have already alluded to a small humerus, the only specimen of a wing-bone in Mr. Mantell's very extensive collection, as presenting the same small proportion to the femur of *Notornis*, which the humerus of *Brachypteryx* does to its femur. The grounds that lead me to hesitate at present in pronouncing *Dinornis* proper to have been a gigantic form of the *Otididæ* or Bustard family in Cuvier's 'Pressirostral section' of Stilt-birds (*Grallæ*) are the extreme difference in the form and proportion of the solid or rostral part of the beak. In *Otis* this is so narrow above as to be trihedral, the upper margin rounded, the lateral ones sharp, and it is as pointed at its termination as in the *Porphyrio*: the long nasal part of the beak is straight, the arch not commencing until the fore-part of the external nostril. The singular adze-shaped beak of *Dinornis* appears to be something more than a mere adaptive modification of the pressirostral type of beak. This type of beak, says Cuvier, "is strong enough to penetrate the ground in search of worms: those species in which it is more feeble frequent meadows and newly-ploughed land, where this food can be procured with greater ease: those that have stronger bills"—*e. g.* the Bustards—"subsist additionally on grain, herbage, &c.[1]" But "the unusual strength of the neck in *Dinornis* indicates the application of the beak to a more laborious task than the mere plucking of seeds, fruits or herbage[2]." I was led to make this remark in my Memoir of 1843, and to suspect from other peculiarities of the skeleton, that the gigantic bird of New Zealand might have found its sustenance in the farinaceous ferns and fern-roots that abound in that island. I am tempted indeed to quote another passage from my earlier Memoir by way of illustration of the claims of Comparative Anatomy to the rank of an exact science by virtue of the predictive power with which its rules may be applied: "the still more robust proportions of their cervical vertebræ," speaking of the gigantic species of *Dinornis*, "and especially of their spinous processes,—so striking when contrasted with the corresponding vertebræ of the Ostrich or Emeu,—may well have been the foundation of those forces by which the beak was associated with the feet in the labour of dislodging the farinaceous roots of the ferns that grow in characteristic abundance over the soil of New Zealand[3]." Now for this kind of work what beak could be better adapted than one framed, as one might say, after the model of the adze or pickaxe? And, for the adequate attachment of such muscular masses as the cervical vertebræ indicated, what modification of the ordinary avian

[1] Règne Animal, i. p. 498. [2] Zool. Trans. iii. p. 269. [3] *Ibid.*

cranium could be better devised than that most singular development in breadth and depth of the occipital region, which so extraordinarily characterizes the *Dinornis*?

Amongst the endless diversity of the forms of the beak in birds, any indication of that which would characterize the *Dinornis*, prior to its actual discovery, might well be deemed a chance guess, and be valued accordingly. The approximation, however, to the truth which is shown by the reduction of the figure of the actual head and beak of *Dinornis* (Pl. LIV. fig. 9) to the proportions of the hypothetical one (*ib.* fig. 8) published in my Memoir of 1843 (vol. iii. pl. 30), may serve to show that such a prevision of an unseen part, founded upon the laws of the correlation of animal structures, becomes, by virtue of the nature of those grounds, something more than a mere guess.

A general conclusion of another kind, and related to a high and important application of philosophic zoology, may be deduced from the amount of agreement of the genera of birds represented by the subjects of the present Memoir to forms of the class peculiar to New Zealand.

The close affinity of the psittaceous genus to that which is peculiar to New Zealand (*Nestor*) has already been noticed.

The *Notornis* in the form of the beak resembles a genus which has its species more widely disseminated, but in the structure of the cranium it shows affinities to birds peculiar to New Zealand, and I believe I shall be able to show that by its sternum and in the bones of its extremities it approaches most closely to the *Brachypteryx*.

The *Palapteryx* is allied by some characters to the *Apteryx*, and by others to the *Dromaius*. It is a peculiar genus of *Struthionidæ*, which takes in some respects an intermediate place between these two forms.

The *Dinornis*, if it have no near ally in any known existing bird of New Zealand, appears to have but little immediate affinity to any of the struthious or other known birds in the rest of the world.

Thus those concordances in the geographical distribution of existing and recently extinct forms of the warm-blooded vertebrate classes which are illustrated by the remains of Elephants, Rhinoceroses, Hippopotamuses, Hyænas, large Bovine and Cervine species, in the pleistocene deposits of Asia and Europe,—by the absence of these, and the presence of gigantic extinct Sloths, Anteaters and Armadillos, &c., in the coeval deposits of South America,—and which have been as strikingly elucidated by the recent discovery of gigantic fossil Kangaroos, Wombats, and Dasyures in the bone-caves and freshwater beds of Australia,—continue to receive as remarkable and conclusive additions by the repeated discovery in the fluviatile deposits of New Zealand of the remains of gigantic forms of bird, allied to those small species which still exist there and there alone. This conformity of geographical localization of the extinct gigantic with the existing smaller birds of New Zealand is the more striking when we remember that the Apteryx and Brachypteryx constituted the highest representatives of the warm-blooded terrestrial animals in the island, which, prior to the advent of Man, appears to have been destitute of any terrestrial mammals, and to owe its present examples of the class to the 'faithful dog' which originally accompanied the Maori, and to the attendant herds and murine vermin that have been subsequently introduced by European voyagers and colonists.

In conclusion, it only remains for me to repeat my acknowledgments to Dr. Mantell for his prompt and liberal accordance to me of the valued privilege of examining and describing these rare and interesting remains: and I beg again to express the high sense of the scientific value of the labours by which his intelligent and enterprising son has made so great an addition to our materials for developing the Natural History of New Zealand.

I have much pleasure also in expressing my acknowledgments to Mr. Gould and Mr. Bartlett, for their kind transmission to me of skins of the *Nestor* and *Porphyrio* in aid of the comparisons of which the results have been detailed in the foregoing pages.

DESCRIPTION OF THE PLATES.

PLATE LII. Dinornis.

Fig. 1. Side view of the cranium and upper mandible of *Dinornis* (probably *D. casuarinus*).
2. Upper view of ditto.
3. Under view of ditto.
4. Back view of ditto.
5. Front view of the cranium, showing the surface from which the beak had been broken off.
6. An oblique view of the hinder part of the cranium, showing the two ridges of the downwardly developed basioccipital ($1''$) and basisphenoid ($5'$), and the anchylosed stylohyal (38).
7. Inner surface of part of the cranium with the pedunculate condyle (1).
8. Under view of the cranium of the Bustard (*Otis tarda*).
9. Oblique view of the hinder part of the same cranium, showing the ridges of the basioccipito-sphenoid answering to those in *Dinornis*.

PLATE LIII.

Fig. 1. Back part of ramus of lower jaw of a large *Dinornis* or *Palapteryx*.
2. Upper view of ditto.
3. Back view of expanded end of ditto.
4. Upper view of lower jaw of an Ostrich (*Struthio Camelus*).
5. Side view of ditto.
6. Back view of expanded end of ditto.

Fig. 7. Under surface of calvarium, showing the cerebral and olfactory cavities, of *Palapteryx geranoïdes*.

8, 9 & 10. Views of the os tympanicum of the *Dinornis casuarinus* (p. 356).

11. Side view of the upper mandible of a species of *Nestor*.

12. Upper view of ditto.

n, the nostril.

22, the groove behind the upper end of the premaxillary part of the mandible.

13. Under view of ditto.

14, 15 & 16. Corresponding views of the upper mandible of a living species of *Nestor* (*N. hypopolius*).

PLATE LIV. Palapteryx.

Fig. 1. Side view of the skull, with lost parts restored in outline, of the *Palapteryx geranoïdes*?

2. Upper view of ditto.
3. Under view of ditto.
4. Back view of ditto.
5. Back view of the extremity of the upper beak.
6. Under view of the portion of lower jaw.
7. Upper view of ditto.
8. Outline of head of *Dinornis* as conjecturally restored in 1843 (see pl. 30).
9. Outline of cranium of *Dinornis* reduced to the same proportions.

PLATE LV. Palapteryx.

Fig. 1. Side view of the cranium of a *Palapteryx*.

2. Back view of ditto.
3. Under view of ditto.
4. Side view of the cranium of a different and larger species of *Palapteryx*.
5. Under view of ditto.
6. Upper view of a mutilated cranium of apparently the same species, indicating the form and proportions of the cerebrum and cerebellum.

PLATE LVI. Notornis Mantelli.

Fig. 1. Side view of the skull of *Porphyrio Sultana*.

2. Upper view of ditto.
3. Under view of ditto.

Fig. 4. Back view of the skull of *Porphyrio Sultana*.
5. Under view of lower jaw.
6. Upper view of lower jaw.
7. Side view of skull, with lost parts restored in outline, of *Notornis Mantelli*.
8. Upper view of ditto.
9. Under view of ditto.
10. Back view of ditto.
11. Interior of cranium of ditto.
12. Under view of lower jaw.
13. Upper view of ditto.

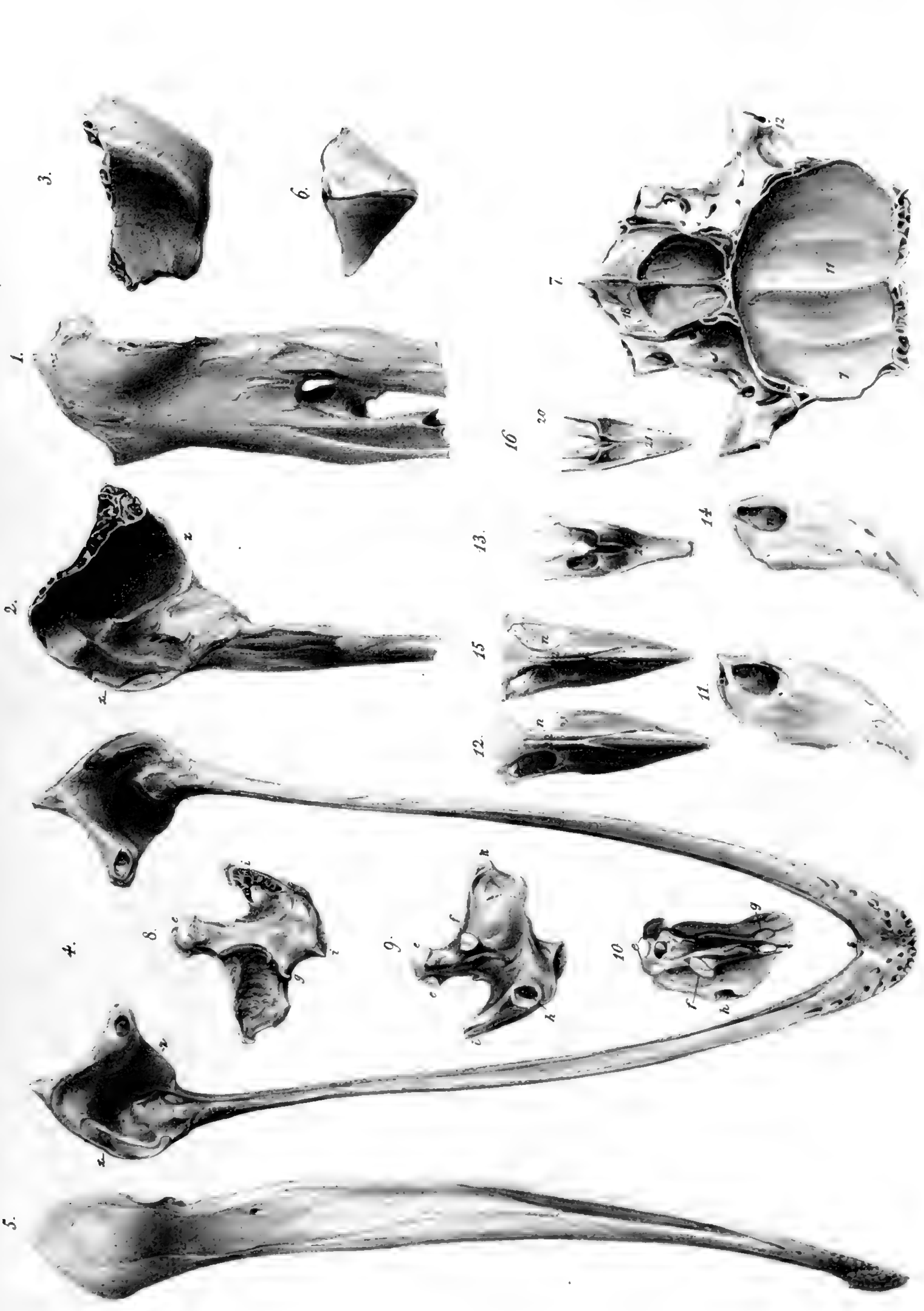
The homologous bones and parts are indicated by the same numbers or letters in each figure, and are explained and referred to in the text.

From Nature on Zinc by J. Erxleben

Nat. Size.

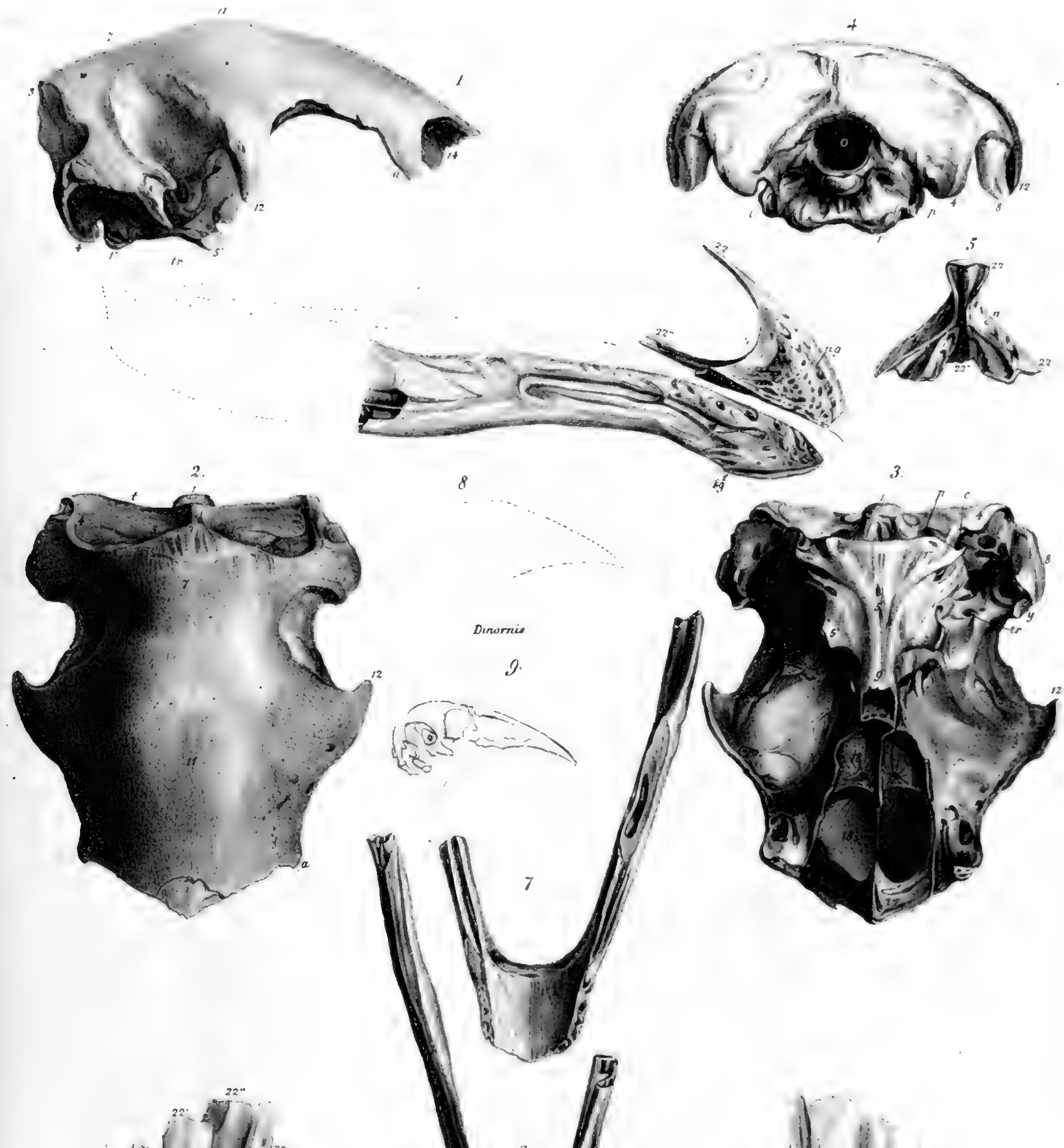
Day & Son Lithog^rs to the Queen

1.-7. *Dinornis*. 8.-9. *Otis*.



From Nature on Zinc by J. Erxleben. Nat. Size. Day & Son Lith^rs to the Queen.

1.-2.-3.-8.-9.-10. Dinornis. 4.-5.-6. Struthio. 7. Palapteryx. 11.-12. Nestor.

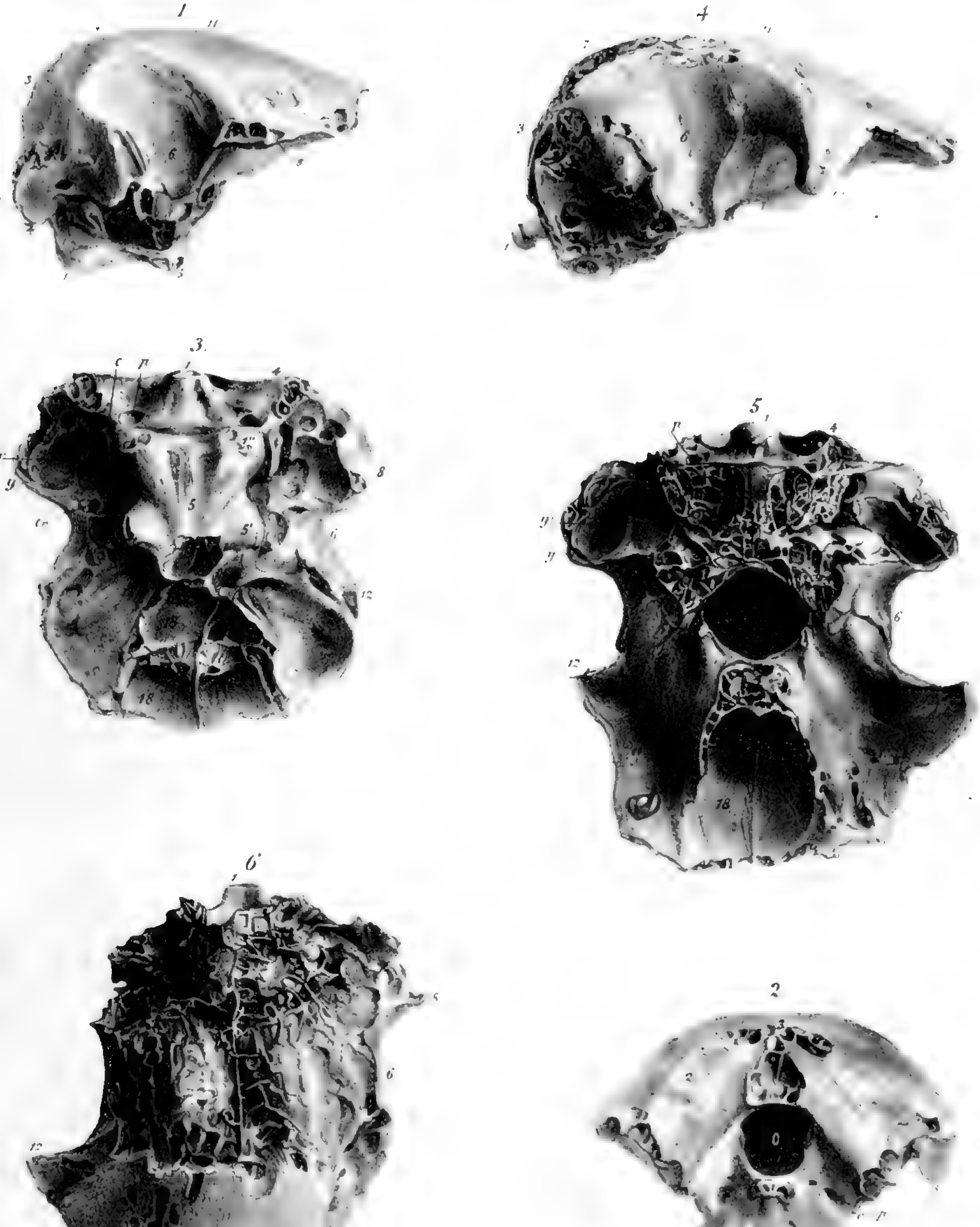


From Nature on Zinc by J. Erxleben.

Nat. Size.

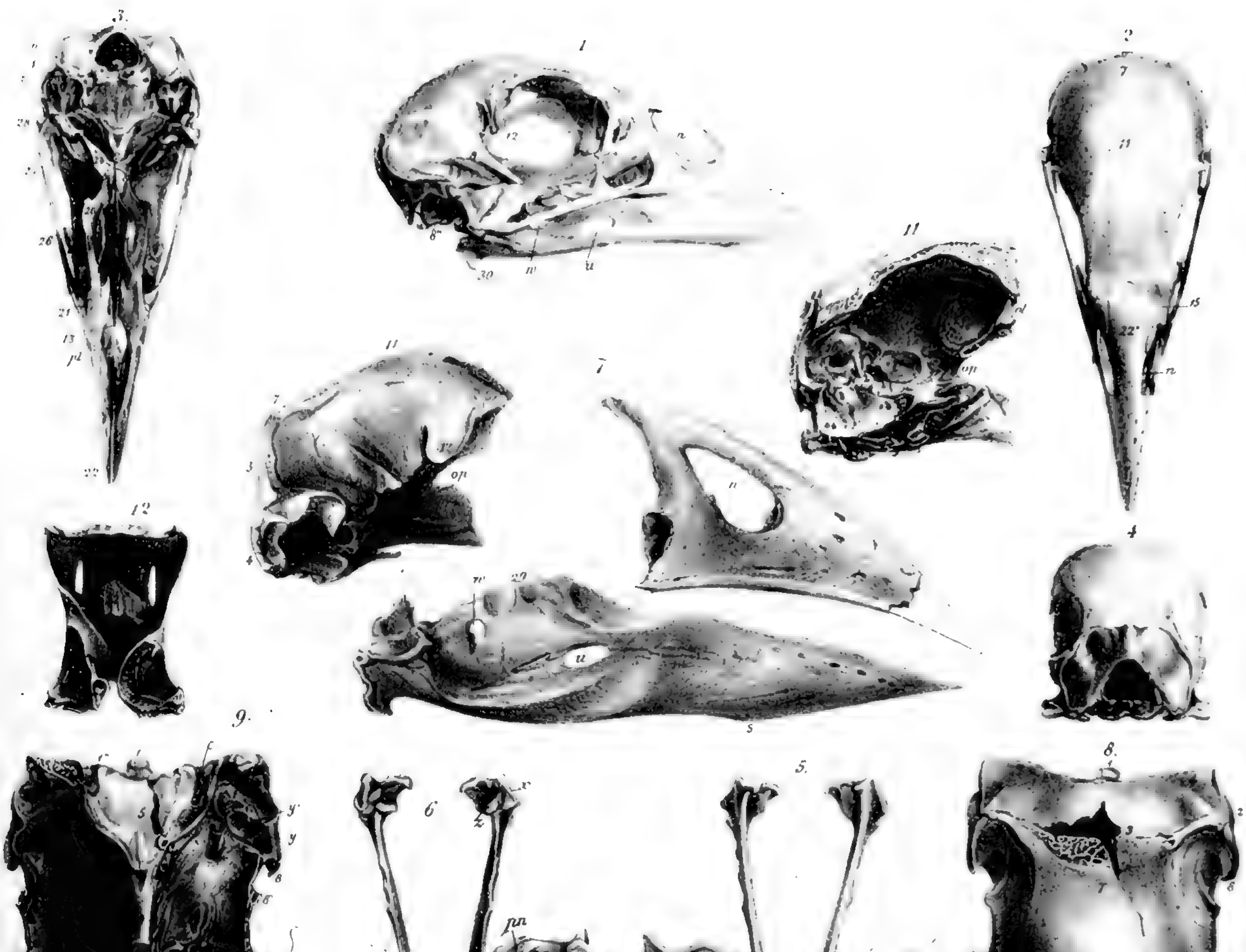
Day & Son Lith.rs to the Queen

Palapteryx.



Nat. Size

Palapteryx



I Dinkel del on Zinc by J. Erxleben

Nat. Size.

Day & Son Lith^rs to the Queen

1 - 6 *Porphyrio.* 7 - 13 *Notornis.*

XVII. *On a new Species of the Genus* Apteryx. *By* John Gould, *F.R.S., F.L.S. &c.*

Communicated June 8th, 1847.

THE acquisition of a new species of *Apteryx* forms one of the most interesting additions to ornithology that has occurred for some years, inasmuch as our knowledge of this remarkable form has hitherto been derived from the single species which has been so elaborately illustrated by Prof. Owen and Mr. Yarrell in the present and preceding volumes of these Transactions. Sufficient information has moreover been transmitted to me by Mr. Frederick Strange of Sydney, to induce a strong belief in my mind of the existence of a third and much larger species in the southern part of New Zealand, where it is known to the sealers who annually visit that coast under the name of the "Fireman," and is said to be about three feet in height. This belief is still further strengthened by the circumstance of a very large egg of some unknown bird having been lately transmitted from New Zealand to this country, which is now the property of T. B. Wilson, Esq., of Philadelphia. The egg in question is said to be that of the Kiwi, and was procured at great risk in the Waikato county; but although my friend Prof. Owen considers it not impossible that it may be the egg of that bird, its great size (five inches by three inches and a quarter), which exceeds that of the Swan, favours the supposition that it belongs to a bird of much larger dimensions.

A single specimen of the new species, which forms the subject of Plate LVII., was sent to me in the beginning of 1847 by Mr. Strange of Sydney, but unfortunately, however, it was unaccompanied by any information. It formed part of a small collection of New Zealand birds, all of which had, I believe, been procured on the Middle Island.

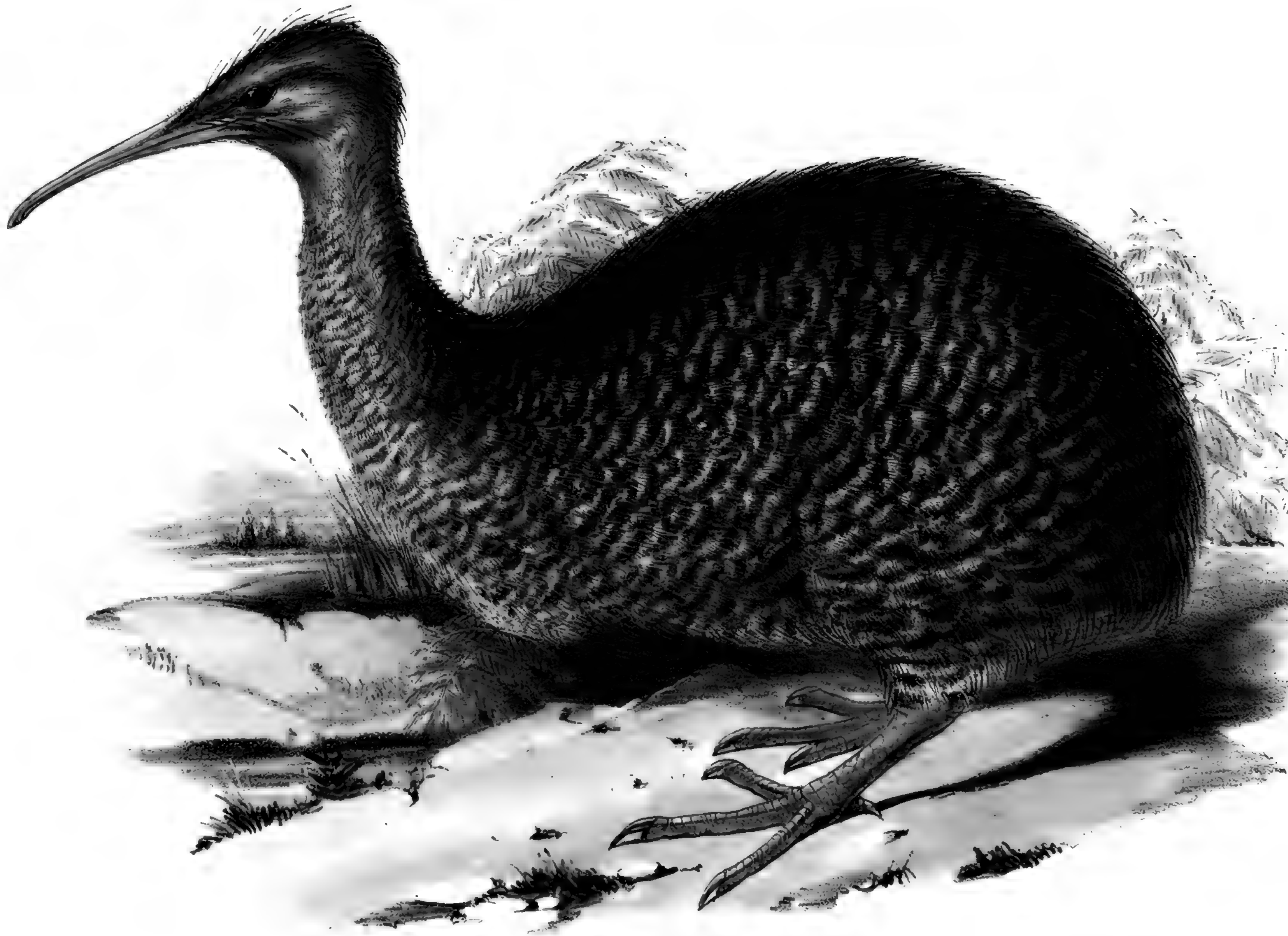
The specimen appears to be fully adult, and is about the same size as the *Apteryx Australis*, from which it is rendered conspicuously different by the irregular transverse barring of the entire plumage, which, with its extreme density and hair-like appearance, more closely resembles the covering of a mammal than that of a bird; it also differs in having a shorter, more slender, and more curved bill, and in the structure of the feathers, which are much broader throughout, especially at the tip, and of a loose and decomposed texture. I propose to characterize this new species under the name of *Apteryx Owenii*, feeling assured that it can only be considered as a just compliment to Professor Owen, who has so ably investigated the group to which it is believed to pertain.

Apteryx Owenii. Ch. sp. *Ap. corpore superiore fusco et fulvo transversim radiato; plumis singulis, ad basim argenteo-fuscis, in medio saturatius fuscis, deinde fasciâ* *semilunari transversâ fulvâ, cui macula succedit informis nigra, ad apicem fulvis. Corpus inferius superiore pallidius, pluma enim quæque inferioris corporis tribus radiis fulvis, superioris tantum duobus ornatur; fulvus quoque color inferiore longius quam superiore corpore in apicibus plumarum extendit.*

Face, head and neck dull yellowish brown; throat somewhat paler; all the upper surface transversely rayed with blackish brown and fulvous; each individual feather being silvery brown at the base, darker brown in the middle, then crossed by a lunate mark of fulvous, to which succeeds an irregular mark of black, and terminated with fulvous; under surface paler than the upper, caused by each feather being crossed by three rays of fulvous instead of two, and more largely tipped with that colour; the feathers of the thighs resemble those of the back; bill dull yellowish horn-colour; feet and claws fleshy-brown.

Total length, from the tip of the bill to the extremity of the body, 18 inches; bill, from the gape to the tip, $3\frac{5}{8}$; breadth at the gape, $\frac{7}{8}$; tarsi, $2\frac{1}{4}$; middle toe and nail, $2\frac{1}{2}$.

The wing is even more rudimentary than in the *Apteryx Australis*.



XVIII. *Osteological Contributions to the Natural History of the Chimpanzees* (Troglodytes, *Geoffroy*), *including the description of the Skull of a large species* (Troglodytes Gorilla, *Savage*) *discovered by* THOMAS S. SAVAGE, *M.D.*, *in the Gaboon country, West Africa. By Prof.* OWEN, *F.R.S.*, *F.Z.S. &c.*

Read February 22, 1848.

§ 1. *Introduction.*

THE principal additions, since the time of Cuvier, to the Natural History of the great Apes that make the nearest approach to Man, are to be found, I believe, in previous volumes of the 'Transactions of the Zoological Society of London,' and are chiefly due to the important aids which the Society has been able to render by its collections and its illustrated publications to those Members who are more immediately engaged in the advancement of its scientific objects.

But of these additions none exceed in interest and importance that to which the present memoir relates, and for the chief subject of which the obligations of naturalists are due to Dr. Thomas Savage, Corr. Member of the Boston Society of Natural History, U.S., and to Mr. Samuel Stutchbury, F.L.S. Before, however, commencing the account of the very remarkable crania which Mr. Stutchbury has obligingly transmitted for exhibition at the Meeting of the Society this evening, and liberally confided to me for description, and which establish the fact of the existence in the western parts of tropical Africa of a second and very large and formidable species of Chimpanzee, a few words may be premised on the principal steps by which the natural history of the Anthropoid Quadrumana has been advanced since the publication of the last edition of the 'Règne Animal*.'

In the first volume of this classical work Cuvier groups the Chimpanzee and the Orang, recognising only a single species of each, in the same subgeneric section of the Linnæan genus *Simia*, and he places the Orang (*Pithecus*, Geoffroy) next to Man, characterizing it as "of all animals that which most resembles Man in the form of the head, the expanse of the forehead (la grandeur de son front)," and other particulars, which have since, however, been proved to be peculiarities of the young individuals of the species in question. Cuvier briefly alludes, at the end of his description, to the great Ape of Borneo, called 'Pongo,' as known only by the skeleton, but which, "maugre the great prominence of its muzzle, the smallness of its cranium and the height of the branches of the lower jaw, might be deemed an adult, if not of the Orang-outang, at

* 8vo, Paris, vol. i. 1829.

least of a closely allied species." This Pongo Cuvier also affirmed to be the largest and most redoubtable of the Apes, as, in fact, it was in comparison with the species known at that time.

Believing the characters of the young Orang to be those of the genus, Cuvier places the Chimpanzee, although he knew it also from immature examples only, below the Orang, on account of the absence of the forehead, the cranium receding immediately behind the supraciliary ridge*.

It was obvious, therefore, that in order to a clear understanding of the zoological relations of the highest of the brute creation to each other as well as to Man, the characters of the full-grown and mature individuals of the Orang and Chimpanzee required to be determined; and to this point I devoted some of my earliest investigations into Comparative Anatomy. In the memoir "On the Osteology of the Chimpanzee and Ourang-Utan," published in the first volume of the 'Zoological Transactions' (p. 343), the great Ape to which Cuvier refers under the name of 'Pongo' was proved, by the comparison of its teeth with the germs of the permanent teeth in the skull of the type of the species called 'Orang-outang' by Cuvier, to be the adult of that supposed anthropoid species.

In my inquiries and researches after specimens which might throw corresponding light on the true nature of the Chimpanzee, I was unexpectedly gratified by finding that there existed in the private collection of a surgeon in London (the late Mr. Walker of St. George's Hospital)—unknown apparently to the naturalists and anatomists of the metropolis—the complete skeleton of an adult female Chimpanzee (*Troglodytes niger*, Geoff.). This specimen yielded the true cranial and other osteological characters of Cuvier's second species of Anthropoid Ape†; and, allowing for sexual distinction, it showed a retrogradation to the brute or baboon-like character in the Chimpanzee during its progress to maturity, analogous to that which had been proved to take place in the true Orang-utan (*Pithecus*).

The comparison of the adult Chimpanzee (*Troglodytes niger*) with the adult Orang (*Pithecus Satyrus*) also showed that the superior development of the forehead upon which Cuvier had relied in determining the relations of the Orang with Man was more apparent than real, and that the more immediate backward slope of the forehead in the Chimpanzee was due principally to the characteristic prominence of the thick supraorbital ridge. Sixteen characters were adduced in the memoir above cited (p. 369) by which the Chimpanzee in differing from the Orang approached nearer to Man, whilst only three equivalent characters of closer correspondence to Man were demonstrated in the Orang; whence it was inferred that the Chimpanzee ought to rank above the Orang and next to Man‡, a conclusion which was adopted by M. de Blainville in his 'Ostéographie§,'

* Règne Animal, 8vo, Paris, vol. i. p. 89, 1829.

† Zool. Trans. vol. i. p. 343, pls. 48, 50, 51 & 52.

‡ Zool. Trans. vol. i. p. 369. § Fasc. i. p. 32.

and has since generally influenced systematic mammalogists in restoring the genuine *Troglodytes* to the same relative position in regard to the *Pithecus Satyrus* which the fabulous *Homo Troglodytes* occupies in the 'Systema Naturæ' of Linnæus.

The dental and osteological differences between the Chimpanzee and Orang, coupled with other anatomical distinctions brought to light by dissection of specimens that had died in the Society's menagerie, enabled me to present a summary of characters showing the difference between those two tailless Apes to be equivalent to that which Cuvier (*loc. cit.* p. 90) sanctions as supporting the generic distinction between the Gibbons and the Orangs. So long, therefore, as groups of this value shall continue to retain proper generic or subgeneric names, *Troglodytes* and *Pithecus* will remain the signs of such distinctions of the Chimpanzees and Orangs respectively, just as *Hylobates* is universally used as the sign of the corresponding distinction of the long-armed tailless Apes*.

Whilst, therefore, the amount and kind of difference between the Chimpanzee and Orang were thus established, the actual extent to which both deviated from the human structure was made known and illustrated by reference not only to the normally developed skull in different races, but by those rare abnormal examples in idiots in which the development of the cranial part of the human skull is arrested at the point to which it arrives in the Anthropoid Apes (Ib. p. 372, Pl. 57 and 58).

In a subsequent memoir† the order of development and succession of the permanent teeth in the Orang (*Pithecus*) were described: the differences in the form of the cranium of the adult males of the two kinds of Orang with great canine teeth, inhabiting respectively the islands of Sumatra (*Pithecus Abelii*) and Borneo (*Pithecus Wurmbii*), were illustrated: some of the dental distinctions between the male and female *Pithecus Wurmbii*, especially in the relative size of the canines, were pointed out; and a smaller and more anthropoid species of Orang from Borneo, with canine teeth relatively shorter than in the female *Pithecus Wurmbii*, with absolutely smaller molar teeth, but with the superior incisors nearly as large, and the inferior incisors quite as large, as those of the *Pithecus Wurmbii*, was established on the characters of the skull and dentition. The differences observed in the two skulls belonging, the one to the great Orang of Borneo, and the other to the great Orang of Sumatra, were not deemed to establish satisfactorily their specific distinction; but with respect to those differences in the proportions of the molar and incisor teeth of a not merely adult but aged skull of the smaller Bornean Orang, as they were superadded to differences of size and figure of the skull itself, greater in degree than the differences between the skulls of the so-called *Pithecus Wurmbii* and *Pithecus Abelii*, they were regarded, according to the analogy of corresponding characters allowed to establish specific distinctions in other genera of Quadrumana,

* Professor Andreas Wagner has expressed his opinion, in his admirable Monograph on the *Quadrumana*, that the osteological differences which divide the Gibbons from the Orangs are greater than those which distinguish the true Orangs from the Chimpanzees. They are greater in degree, but not in kind.

† Zool. Trans. vol. ii. p. 165, 1836.

as significative of a second, smaller, and more anthropoid species of Orang, for which, therefore, I proposed the name of *Simia* (*Pithecus*) *Morio*.

This conclusion in my 'Second Memoir' did not meet with such general assent as those of the first. To the objections published by M. Dumortier*, and supported ably, candidly and openly by reference to all the facts that had led to his entertainment of them, and to his opinion that my *Pithecus Morio* was an immature stage of the larger *P. Wurmbii*, I have replied in detail†.

It will not be necessary to reiterate these arguments in refutation of the statement of the specific identity of the *Simia Morio* with the *Simia Wurmbii*, since made by Mr. John Edward Gray in the 'Synopsis of the Mammalia in the British Museum,' as no reasons are there adduced for the attempt to suppress the species; and I only here refer to the statement because it may have some weight with foreign naturalists, inasmuch as it emanates from the ostensible head of the Zoological department of the British Museum, and is enunciated in a work of a certain public authority and bearing the imprimatur of the eminent and distinguished personages constituting the Board of Trustees.

Temminck, Sandifort, Salomon Müller and Schlegel have contributed valuable facts to the history and anatomy of the great Orang (*Pithecus Wurmbii*), to which species their observations are limited‡.

Sir J. Brooke, the distinguished Governor of Labuan and Rajah of Sarāwak, affirms, as the result of his personal observations and according to the report of the natives of Borneo, that there exist in that island three species of Orang§. One species, called by the natives '*Mias Pappan*,' with cheek-callosities in both males, females and young, is my *Pithecus Wurmbii*. A male of this species measured four feet from the head to the heel. A second species, smaller and weaker, devoid of cheek-callosities in both sexes, and with relatively smaller hands and feet, is known to the natives by the name of '*Mias Kassar*.' The Rajah Brooke has killed an almost full-grown male and two grown females of this species, which he believes to be my *Pithecus Morio*. A third species, '*Mias Rambi*,' is as tall as the *Mias Pappan*, or even taller, but is not so stout, with longer hair, and without cheek-pouches in either sex. This may possibly be the variety or species called *Pithecus Abelii*.

Thus the former memoirs published in the 'Transactions of the Zoological Society' give the true characters of a species of large Orang (*Pithecus Wurmbii*) in Borneo, and demonstrate a sexual superiority of size of the large laniariform canine teeth in the male, with a concomitant development of zygomatic arches and sagittal and lambdoidal crests. They show that there were two well-marked varieties, if not species, of such large Orang-utans, of which one at least inhabits Sumatra, and both are probably to be

* Notice sur les Modifications du Crane de l'Orang-outang, 8vo, Bruxelles, 1838.

† Annales des Sciences, series 2. t. xi. p. 122.

‡ Verhandelingen over de Natuurlijke Geschiedenis der Nederlandsche overzeesche, &c. fol. Leyden, 1840.

§ Proceedings of the Zoological Society, July 13, 1841.

found in Borneo;—that, besides the *Pithecus Wurmbii* and the variety or species called *Pithecus Abelii*, a smaller and more anthropoid Orang (*Pithecus Morio*), with proportions of the incisor and molar teeth as contrasted with the larger species not hitherto known to characterize mere varieties of Ape, also exists in Borneo, and is apparently peculiar to that island;—and, notwithstanding the carnassial and baboon-like features are less strongly developed in the *Pithecus Morio* than in its larger congener, that the characters of the Orang-outang in the 'Règne Animal' of Cuvier apply only to the immature state of any of the species of *Pithecus* now known. The same essential correction of the current ideas respecting the facial angle and the proportions of the cranium and face was made with respect to the Chimpanzee, and the true adult characters of the skeleton and dentition as manifested in the female of the *Troglodytes niger* were described and illustrated; and it was shown by these that, although the departure from the bimanous type is not so great in the *Troglodytes niger* as in the *Pithecus Wurmbii*, it is quite equal to that in the *Pithecus Morio*.

§ 2. *Of the Skull and Dentition of the adult male* Troglodytes niger.

There remained then to be determined the true adult characters of the male of the *Troglodytes niger*, and especially those afforded by the bones and teeth. In general stature, the male of this species, when it has acquired its second or mature dentition, does not exceed the female by more than two inches, and does not attain a greater height, measured from the sole of the heel to the vertex in a straight line, than 4 feet, the height of the mature female being 3 feet 10 inches; but it presents a greater proportional breadth of chest and shoulders, and greater strength of arm. It is characterized, however, by the same sexual superiority in the size of the canines as is manifested in the genus Orang (*Pithecus*).

The following are the general characters of the mature dentition of the adult male Chimpanzee (*Troglodytes niger*):—

This dentition, though in all its principal characters strictly quadrumanous, yet, in the minor particulars in which it differs from the dentition of the Orang, approaches nearer the human type. In the upper jaw the middle incisors (Pl. LIX. *i* 1) are smaller, the lateral ones (*ib. i* 2) larger than those of the Orang*; they are thus more nearly equal to each other; nevertheless the proportional superiority of the middle pair is greater than in Man, and the proportional size of the four incisors both to the entire skull and to the other teeth is considerably greater. Each incisor has a prominent posterior basal ridge, and the outer angle of the lateral incisors is rounded off as in the Orang. The diastema between the incisors and the canine on each side is as well-marked in the male Chimpanzee as in the male Orang†. The crown of the canine (*ib. c*), passing outside

* Compare Pl. LIX. with Pl. XXXI. (*Pith. Wurmbii*) and Pl. XXXIII. (*Pith. Morio*), in vol. ii. Zool. Trans.

† Compare Pl. LVIII. with Pl. XXXII. (*Pith. Wurmbii*) in vol. ii. Zool. Trans.

the interspace between the lower canine and premolar, extends in the male *Troglodytes niger* a little below the alveolar border of the under jaw when the mouth is shut: the seventh character*, therefore, of the genus, 'apices of canines lodged in intervals of the opposite teeth,' when the mouth is closed, is applicable only to the female, and does not distinguish *Troglodytes* from *Pithecus*. The upper canine of the male *Troglodytes niger* is conical, pointed, but more compressed than in the Orang, and with a sharper posterior edge; convex anteriorly, becoming flatter at the posterior half of the outer surface, and concave on the corresponding part of the inner surface, which is traversed by a shallow longitudinal impression: a feeble longitudinal rising and a second linear impression divide this from the convex anterior surface, which also bears a longitudinal groove at the base of the crown. The canine is rather more than twice the size of that in the female. Both premolars (*ib.* 1 *p*, 2 *p*, Pl. LX.) are bicuspid; the outer cusp of the first and the inner cusp of the second being the largest, and the first premolar consequently appearing the largest on an external view (Pl. LVIII.). The difference is less marked in the female. The anterior external angle of the first premolar is not produced as in the Orang. In Man, where the outer curve of the premolar part of the dental series is greater than the inner one, the outer cusps of both premolars are the largest: the alternating superiority of size in the Chimpanzee accords with the straight line which the canine and premolars form with the true molars.

The true molars (Pl. LX. 1 *m*, 2 *m*, 3 *m*) are quadricuspid, relatively larger in comparison with the bicuspids than in the Orang: the last is the smallest by the feeble development of the two hind cusps. In the first and second molars a low ridge connects the antero-internal with the postero-external cusp, crossing the crown obliquely, as in Man. There is a feeble indication of the same ridge in the unworn molars of the Orang; but the four principal cusps are much less distinct, and the whole grinding surface is flatter and more wrinkled, than in the Chimpanzee. A low ridge girts the base of the antero-internal cusp of each of the upper true molars in the male Chimpanzee: it is less marked in the female. The premolars as well as molars are severally implanted by one internal and two external fangs, diverging but curving towards each other at their ends as if grasping the substance of the jaw. The two outer fangs of the second premolar are connate in one female specimen.

In the lower jaw the lateral incisors are broader than the middle ones, but have their outer angle rounded off; they are all much larger and less vertically implanted than in Man (Pls. LVIII. & LIX.). The lower canines are two inches in length, including the root; the enamelled crown is three-fourths of an inch in length, and two-thirds of an inch across the base; it is conical and trihedral; the outer and anterior surface is convex, the other two surfaces are flattened or subconcave, and converging to an almost trenchant edge directed inwards and backwards; a ridge separates the convex from the antero-internal flat surface; both this and the posterior surface show slight traces of a

* Zool. Trans. vol. i. p. 372.

longitudinal rising at their middle part. The lower canine shows the same relative superiority of size as the upper one compared with that in the female Chimpanzee. The canine almost touches the incisor, but is separated by a diastema one line broad from the first premolar. This tooth is larger externally than the second premolar, and is twice the size of the human first premolar; it has a subtrihedral crown, with the anterior and outer angle produced forwards, slightly indicating the peculiar feature of the same tooth in the Baboons. The summit of the crown terminates in two sharp trihedral cusps, the outer one rising highest, and the second cusp being feebly indicated on the ridge extending from the inner side of the first: the crown of the first has a thick ridge at the inner and posterior part of its base. The second premolar has a subquadrate crown, with the two cusps developed from its anterior half, and a third smaller one from the inner angle of the posterior ridge. Both the lower premolars are implanted by two antero-posteriorly compressed divergent fangs, the anterior one being the largest. The three true molars are almost equal in size, the first being very little larger than the last, which is the only molar as large as the corresponding tooth in the black varieties of the human subject*, in most of which, especially the Australians, the true molars attain larger dimensions than in the yellow or white races. The four principal cusps, especially the two inner ones, of the first molar of the Chimpanzee are more pointed and prolonged than in Man: a fifth small cusp is developed behind the outer pair, as in the Orangs and the Gibbons, but is less than that in Man. The same additional cusp is present in the second molar which is seldom seen in Man. The crucial groove on the grinding surface is much less distinct than in Man, not being continued across the ridge connecting the anterior pair of cusps in the Chimpanzee. The crown of the third molar is longer antero-posteriorly from the greater development of the fifth posterior cusp, which however is rudimental in comparison with that in the Semnopitheques and Macaques. All the three true molars are supported by two distinct and well-developed antero-posteriorly compressed, divergent fangs, longitudinally excavated on the sides turned towards each other. The molar series in both jaws forms a straight line, with a slight tendency in the upper jaw to bend in the opposite direction to the well-marked curve which the same series describes in the human subject.

In the skull of a male *Troglodytes niger* (Plates LVIII. LIX. & LX.) in which all the teeth and especially the canines had been moderately worn, the cranium is not so much larger proportionally than the female's as it is in the male of the *Pithecus Wurmbii*, neither are the zygomatic nor the cranial cristæ so much more developed. The temporal ridges (Pl. LIX. 11) converge more rapidly from the ectorbital processes (12), and meet two inches behind the glabella, forming a low single sagittal ridge (7), extending backwards in one specimen for an inch and a half, and then dividing again and curving outwards to the better-developed lambdoid and mastoid ridges (fig. 1, 8); whilst in another

* See my Odontography, Pl. CXIX. fig. 2 *m*.

specimen the sagittal crest is continued, one quarter of an inch in height, to the middle of the lambdoidal crest.

This crest is more developed than in the female, but the supraoccipital preserves its convexity, though not quite to such a degree as in the female. The baboon-like length of the face and prominence of the orbits is quite as strongly marked in the adult male as in the female, but the carnivorous aspect arising from the sagittal and lambdoidal crests is not so striking as it is in the *Pithecus Wurmbii*; and although the canines of the male *Troglodytes niger* are decidedly superior to those of the female and extend beyond the intervals of the opposite teeth, yet this is to a less extent than in the *Pithecus Wurmbii.* The fossa for the insertion of the masseter and temporal muscles is better marked in the lower jaw of the male than in the female *Troglodytes niger*, and its posterior boundary was developed into a tubercle in the specimen figured in Pl. LVIII.

Upon the whole, the amount of sexual distinction in the skull and dentition of the *Troglodytes niger* accords with that which is observed in the *Pithecus Morio* or the smaller Orang of Borneo, and is not so great as in the *Pithecus Wurmbii.* With this knowledge, therefore, of the dental and osteological characters of the *Troglodytes niger*, we are in a condition for satisfactorily testing any similar evidence of that larger species of Chimpanzee, the existence of which was long ago indicated by Battell* under the name of 'Pongo' as contradistinguished from the 'Chimpanzee' of modern naturalists, which he calls 'Engeco'; the 'Pongo' or 'Boggo' being subsequently more definitely alluded to by Lacépède in the 'Supplément,' tom. vii. (4to, 1789) p. 2 of Buffon's 'Histoire Naturelle,' as a large African 'Orang-outang,' 5 feet in height, and of which Lacépède believed the smaller black Orang, $2\frac{1}{2}$ feet high, of whose docile and social habits, under the name of 'Jocko,' Buffon has left so pleasing a record, to have been the young.

Such indications however are of little other value in rigorous natural history than as guides and stimulants to more special inquiry, and as inciting to the collection of confirmatory evidence. Yet it must be admitted, that if Lacépède were open to the charge of yielding too ready acceptance to the older notices of the great African Chimpanzee, Cuvier, who subjected him to it, fell into the opposite extreme of scepticism in pronouncing this remarkable animal,—the Pongo of Buffon,—to have been "only the imaginary product of that great naturalist's combinations†." What has been, however, now securely gained for science is the determination of the true stature, dentition, facial angle and other adult characters of the Chimpanzee of Cuvier and others (*Troglodytes niger*); upon which basis I proceed to engraft further illustrations of the genus, which of all brute mammalia is the most important, from its demonstrated closest proximity to Man.

* See Purchas's Pilgrims, vol. ii. p. 982.

† Règne Animal, tom. i. p. 88.

§ 3. *Indications and discovery of the adult* Troglodytes Gorilla, *Savage.*

The first intelligence which revived a feeling of faith and interest in the subject of the notices above-cited from Battell and the continuator of Buffon, reached me in the early part of last summer in a letter from Dr. T. S. Savage, a zealous and accomplished Missionary of the Protestant Episcopalian establishment at New York, with whom I had previously corresponded on the subject of the Chimpanzee, and by whom specimens of the young animal had been transmitted from the west coast of Africa to the Royal College of Surgeons in London. The letter in question was dated

"Protestant Mission House, Gaboon River, West Africa,
April 24, 1847.

"My dear Sir,—Your known interest in the zoology of Africa will find a ready excuse, I trust, for the following communication, and lead you in the midst of various engagements to give me a few moments in reply. I am on my way to the United States in a vessel which, to complete its voyage, had to touch at this point. I find it a region rich and untried in all the departments of natural history, besides being full of interest in a far more important point of view,—that of a missionary field. I have found the existence of an animal of an extraordinary character in this locality, and which I have reason to believe is unknown to the naturalist. As yet I have been unable to obtain more than a part of a skeleton. It belongs to the Simiadæ, and is closely allied to the Orangs proper. It reaches nearly if not quite the height of five feet in the adult state, and is of a large size. I am considerably in doubt in regard to its identity with an animal said to have been known to Buffon as a large species of Orang-outang, under the name of Pongo. It is referred to in a note on the 58th page of the 1st volume of the American edition of Cuvier's 'Règne Animal,' where he asserts that Pongo is a corruption of Boggo, which is given in Africa to the Chimpanzee or to the Mandrill, and was applied by Buffon to a pretended large species of Orang-outang, the mere imaginary product of his combinations; and then he says that Wurmb, a naturalist of Batavia, transferred the name (Pongo) to a monkey in Borneo, which he thinks identical with *Pithecus Satyrus* (the real Orang-utan, a red Orang of Asia). My excellent friend the Rev. J. L. Wilson, Senior Missionary of the American Board of Commissioners for Foreign Missions to this part of Africa, thinks that Pongo comes from 'Mpongive,' the name of the tribe, and consequently the region, on the banks of the Gaboon river, near its mouth, among which tribe he has resided for about five years. The tribe once extended a great distance on the coast above and below the river Gaboon, and the languages spoken for a great distance, both above and below, are evidently but dialects with the Mpongive of one language. Whence Buffon professed to receive his specimen of "large species of Orang-outang" I know not, but this region and its vicinity indefinitely are the only points at which, so far as I can ascertain, "a large species of Orang-outang" has been heard of except the Chimpanzee, which is now well-known. I have seen it mentioned that the skeleton of the Pongo of Borneo is in the Royal College of Surgeons, of which institution you are a Professor. Now, may I solicit your aid in this matter? I will send you outlines of the skull of the male and female (adults) and ask the favour of a reply to my letter, stating whether you can identify them with that of any animal you know of under the name of Pongo or any other cognomen. I have no correspondent in Paris: if you feel sufficient interest in the subject, will you do me the favour to ascertain from that city the fact whether such skulls exist in any cabinet there? The natives state that a young one was caught many years ago and sold to a French captain, who never returned, and that it was the only individual taken out of the river. From what I know, the young skull would very much resemble that of the Chimpanzee. I have four crania (two male and two female) with many bones, though not a perfect skeleton, but I hope to complete one before I leave the river, and to procure a dead subject, which I shall preserve in spirits; great uncertainty, however, attends my success, as they are indescribably fierce and dangerous, and are found only far in the interior; they are killed by elephant-hunters only in self-defence.

"Below you have a sketch of the cranium of the male and female*, executed for me by Mrs. Prince, the wife of Dr. Prince, the English Baptist missionary at Fernando Po, who is here for a short time in search of health. *a a* are two low ridges converging, as seen in the sketch, and uniting at *x*, and forming a strong prominent ridge in the course of the sagittal suture, which comes into a junction with a lateral ridge (*d*) sent back from the petrous portion of such temporal bone: *e* is a strong fossa of triangular shape between the ridges *a a*. The space between the zygoma and temporal bone in a transverse direction is one inch and three quarters deep; the diameter from before backwards three inches; at *b* is a sinus about half an inch in depth and an inch in length, with foramina for the passage of blood-vessels and nerves. The two upper middle incisor teeth are absent, but their sockets show their size to have been nearly if not quite double the two outer ones. The two lower middle incisor teeth are narrower than the two outer. The female cranium is a full-grown one, but differing from the male in the prominence of the ridges: the two anterior corresponding to *a a* in the male and the central are rudimental only, except at the extremes of the latter, where it joins the posterior transverse ridge, lettered *d* in the male. It has lost the two middle upper incisors, which bear the same relation in respect to size to the two outer that those of the male do. All the incisors, both in the upper and lower jaw, are larger than they are in the male: the canines in the female are shorter than in the male. These points are all that I need specify to enable you to identify the crania with any in your possession. You will greatly oblige me by a comparison, and communicating the result at your earliest convenience."

I lost no time in making the comparisons and transmitting the results to my esteemed correspondent: they were in substance to the effect, that the skulls figured and described in his letter, though resembling that of the great Orang of Wurmb in the development of the sagittal and lambdoidal crests, and in the sexual difference in the development of the canine teeth, differed plainly from it by the greater size and prominence of the supraorbital ridge, and in that respect resembled the known Chimpanzee. As I had at that time ascertained the characters of the adult dentition of a nearly full-grown male *Troglodytes niger*, but had not seen a skull of the old animal, the superior size of the canines to those in the female led me to suspect that the sagittal and lambdoidal crests might acquire in strong and aged individuals the proportions of those represented by Dr. Savage, and that thus the resemblance to the Pongo of Wurmb in this respect might be manifested by the adult male of the *Troglodytes niger*. Without the means of making a more detailed comparison, and in the absence of the skull of an old male Chimpanzee (which by the kindness of my friend Mr. Stutchbury I have now been enabled to describe and figure, Plates LVIII. LIX. and LX.), I could not feel satisfied that the specimens alluded to by Dr. Savage had belonged actually to a distinct species of *Troglodytes*. In the absence, therefore, of means of making comparisons of other characters, besides superior size, larger canine teeth, and concomitant strong sagittal and lambdoidal cristæ, as these were indicated in the sketches transmitted, I deemed it better to communicate my doubts to Dr. Savage than to hazard in the publications of the

* Woodcuts of these figures are given in the abstract of the present memoir published in the 'Proceedings of the Zoological Society,' Feb. 22, 1848, p. 29.

Society a premature indication of a species which might prove to be a sexual, or a local, larger and stronger, variety of Chimpanzee.

My friend Mr. Samuel Stutchbury of Bristol, having received similar statements of the existence of a large and formidable species of Chimpanzee in the Gaboon district, from the officers of vessels trading from Bristol to the west coast of Africa, urged them to endeavour to obtain specimens of it; and the result was that Captain George Wagstaff succeeded in procuring at the Gaboon river, in December 1847, three skulls of the large species and one of the smaller species of Chimpanzee, all adult.

One of the skulls of the large species (*Troglodytes Gorilla* *) was of a very old male; the length of the skull was $11\frac{1}{2}$ inches (0·29), with the molars worn nearly to the stumps and the crown of the canine reduced, partly by fracture, partly by attrition, to its basal portion: its pulp had been inflamed, and had produced ulceration of the alveolus.

A second skull (Pls. LXI. LXII. and LXIII.) was also of a male of equal size, with the full dentition of maturity, but a younger animal, with merely the summits of the cusps of the molars and the margins of the incisors slightly worn.

The third skull of the large *Troglodytes* was of a female, 9 inches (0·23) long, with the mature dentition, and with the molars not more worn than in the younger adult male.

The fourth skull was of a female adult Chimpanzee, $7\frac{1}{4}$ inches (0·185) in length, of the smaller species (*Troglodytes niger*), with the complete permanent dentition, and the teeth more abraded than in the two preceding skulls. Mr. Stutchbury afterwards transmitted to me the cranium of an old male *Troglodytes niger*, $8\frac{1}{2}$ inches (0·220) in length. The lower jaw was wanting in each of the foregoing specimens, and the occipital or basal part of the skull had been more or less fractured; the skull of the young but full-grown male of the great *Troglodytes Gorilla* being the most perfect.

Captain Wagstaff reached Bristol in a broken state of health, and died soon after his arrival. The only information relative to these rare and valuable contributions to zoology which Mr. Stutchbury was able to obtain from him was that the natives, when they succeed in killing one of these Chimpanzees, make a 'fetish' of the cranium. The specimens bore indications of the sacred marks in broad red stripes crossed by a white stripe, of some pigment which could be washed off. Their superstitious reverence of these hideous remains of their formidable and dreaded enemy adds to the difficulty which a stranger has to contend with in obtaining specimens.

* In the original description of these specimens I had called the species after its discoverer; but I subsequently received the memoir by Dr. Savage and Prof. Wyman in which the name *Gorilla* is proposed for it, which I have therefore substituted for the name *Troglodytes Savagei*, which appears in the abstract of the present memoir in the 'Proceedings of the Zoological Society,' Feb. 22, 1848, p. 27.

§ 4. *Comparison of the Skull of the* Troglodytes Gorilla, *Savage, with that of the* Troglodytes niger, *Geoff.*

Independently of the superiority of size of the *Tr. Gorilla*, the sexual difference in respect of which is greater in that large species than in *Tr. niger*, there are well-marked differences of form, differences in the development and proportions of the intermuscular ridges, and, what is more decisive of specific distinction, in the disposition of certain sutures and in the structure and proportions of certain teeth. Compared in profile, as in Plates LVIII. and LXI., the skulls of both species present the striking difference from the two Orangs (vol. ii. Pls. XXXI. and XXXIII.) in the prominence of the supraorbital ridge; but this is greater in the *Tr. Gorilla*, and occasions a deeper concavity below it, the vertical prominence descending from the middle of the supraorbital ridge being more marked. The temporal ridges, after their junction upon the frontal, rise into a strong and lofty sagittal crest, which is continued to the lambdoidal crest. This is enormous in the *Tr. Gorilla*, and, with the zygomatic process, renders all the posterior and lateral parts of the calvarium concave. The same extent of the lambdoidal crest masks or rather destroys the posterior convexity of the occiput in *Tr. Gorilla*, so that in the direct side view of the cranium only the outline of the large mastoid cells appears at this part. The *foramen auditorium externum* being of the same size as in the *Tr. niger*, is relatively smaller in the *Tr. Gorilla*. The zygomatic arch is proportionably much stronger in the large Chimpanzee, and also differs from that in *Tr. niger* by the squamosal part (27) being of equal depth with the malar part (26), and by its having its upper border convex or produced into an angle instead of being straight or slightly concave. The alisphenoid (6) is longer and narrower in *Tr. Gorilla*, and contributes less to the back wall of the orbit than in *Tr. niger*, in which it forms a much smaller proportion of that part than in Man. The spheno-maxillary fissure is not only larger in *Tr. Gorilla*, but is narrower and more vertical, not angularly bent as in *Tr. niger*. The extent of the premaxillary bones below the nostril is not only relatively but absolutely less in *Tr. Gorilla*, and the profile of the skull less convex at that part, or less 'prognathic,' than in *Tr. niger*.

More important differences appear on comparing the two skulls in a front view (Plates LIX. and LXII.). The breadth of the premaxillaries (22) and of the incisor teeth is the same in both, whilst in all other dimensions the *Tr. Gorilla* greatly surpasses the *Tr. niger*: this is seen in the height of the sagittal crest, the thickness of the great supraorbital bar of bone, the prominence of the ectorbital walls (12, 26′, Pl. LXII.), and of the inferior tumid malar boundaries of the orbits. But the decisive specific character is given by the form and connections of the nasal bones. These have coalesced together in *Tr. Gorilla* as in *Tr. niger*, but less completely, the median suture remaining along the lower half (15, Pl. LXII.). The coalesced upper portions of the nasals (15′) ascend higher above the nasal processes of the maxillary than in *Tr. niger*, become contracted between those processes and there project slightly, their median coalesced margins being inclined forwards, and thus offering a feature of approximation to the human structure, which is very faintly indicated, if at all, in the skull of the *Tr. niger*. The nasal bones however subside in the larger species as they expand at their lower halves, where they form a nearly flattened oval disc, terminating in a slight point below, and articulating laterally not only with the maxillary bones, but with an expanded superior portion of the premaxillaries (22'). A considerable extent of the sutures uniting these bones with the maxillaries remains in both the adult male and female skulls of *Tr. Gorilla*, whilst those sutures are very early obliterated in the *Tr. niger*. The ninth character, therefore, by which the Chimpanzee more nearly resembles Man than the Orang does*, applies to the smaller species of *Troglodytes*, and not to the genus.

In the specimen of the skull of an immature *Tr. niger*, with only the twenty deciduous teeth in place, in the museum of the College of Surgeons†, the maxillo-premaxillary sutures, still traceable at the sides of the nasal aperture as well as on the palate, show that each premaxillary bone terminates above in a point which does not reach the nasals: in another specimen, a little more advanced, for the inspection of which I am indebted to Mr. Stutchbury, the upper pointed ends of the premaxillaries reach the confluent nasals, and divide their lower extremity from the nasal processes of the maxillaries; but they do not expand there as in the *Tr. Gorilla*, and the sutures of the premaxillaries disappear in the adult of the *Tr. niger*‡. In all the specimens of the adult *Tr. Gorilla* a greater or less proportion of the sutures of the premaxillaries remain, and show that the premaxillaries expand at their upper extremities and form a triangular plate of bone on the outer surface of the face which ascends, above the bony nostril, upon the sides of the lower half of the lower expanded part of the confluent nasals, separating that part from the maxillary bones, and excluding the maxillaries from the periphery of the external nostril. This character of the premaxillaries is constant in three skulls of the *Tr. Gorilla* first transmitted by Mr. Stutchbury, and in two others which he has subsequently sent; and I regard it as decisive of the specific distinction of the *Tr. Gorilla*.

The inferior or alveolar part of the premaxillaries, on the other hand, is shorter and less prominent in *Tr. Gorilla* than in *Tr. niger*, and in that respect the larger species deviates less from Man. The anterior surface of the premaxillaries is more irregular or undulated by the prominent sockets of the incisors in *Tr. niger* than in *Tr. Gorilla*. The nostril is a wider and more regular ellipse in *Tr. Gorilla*; it is contracted above in *Tr.*

* Zool. Trans. vol. i. p. 368.

† This is the specimen alluded to by Mr. Lawrence when treating of the intermaxillary bone in the fourth chapter of his "Lectures on the Natural History of Man," 8vo, 1819, p. 174.

‡ M. de Blainville, describing the skull of the Chimpanzee from a young specimen of the *Tr. niger*, says, "Mais les prémaxillaires, qui offrent la particularité de toucher à peine les os du nez et de souder de fort bon heure avec les maxillaires." (Ostéographie, fasc. i. p. 33.)

niger, which gives it an ovate form with the great end downwards, and thus it more resembles the form of that aperture in Man.

The orbits have a more subquadrate form, with the angles rounded off, in *Tr. Gorilla* than in *Tr. niger*; but their periphery is less sharply defined, especially below, than in *Tr. niger*. The æthmoidal cells are more swollen out, giving the interorbital space a greater breadth below and the lachrymal fossæ a more anterior aspect in *Tr. Gorilla*.

The infraorbital canal is open from its posterior commencement to where it perforates the lower border of the orbit, and it issues upon the face relatively lower and further from the orbit in the *Tr. Gorilla* ($21'$). In two skulls of the *Tr. niger* the infraorbital canal is overarched by bone at both ends, and is a deeper and narrower fissure at the intervening part than in *Tr. Gorilla*: in a third skull of *Tr. niger* the canal is deeper, narrower and longer than in *Tr. Gorilla*.

The whole nasal bone is relatively longer, and the distance from the orbits to the external nostril greater in the *Tr. Gorilla*.

The malar bone is more convex outwardly, and is more remarkable for its vertical extent: it is flatter and developed more transversely in the *Tr. niger*.

The larger proportional size of the canines in *Tr. Gorilla* impresses a corresponding difference upon the alveolar part of the maxillary bone in that species.

In comparing the skulls of the two species by a view of their base (Plates LX. and LXIII.), the first remarkable difference is the broad, flat, or slightly concave supraoccipital surface of the larger species as compared with the uniformly convex character of the same part in the other, the outline of this part being rounded in *Tr. Gorilla* and almost angular in *Tr. niger**: the difference is due to the much thicker and broader lambdoidal ridge in the larger species, which prolongs the surface far beyond the cerebellar fossa, and gives the condyles and foramen magnum a rather more advanced position as compared with the *Tr. niger*. The next character, which is also a more anthropoid one, though explicable in relation to the greater weight of the skull to be poised upon the atlas, is the greater prominence of the mastoid processes in the *Tr. Gorilla* (*m*, Pl. LXIII.), which are represented by only a rough ridge in the *Tr. niger* (*m*, Pl. LX.). These protuberances are cellular, and with a very thin outer layer of bone in the *Tr. Gorilla*. The lower surface of the long tympanic or auditory process (28, Pl. LX.) is smooth and flat, or slightly concave, in *Tr. niger*, and developes a slight tubercle anterior to the stylohyal pit (38): in the *Tr. Gorilla* the same process (28, Pl. LXIII.) is more or less convex below, and developes a ridge (*v*), answering to the vaginal process, on the outer side of the carotid canal (*c*); and in one instance the ridge extended, like the vaginal process in Man, the whole length of the auditory process, the under surface of which was, as it were, pinched up orcompressed from before backwards.

* In one of the skulls of the male *Tr. niger* before me, there is a small vascular, supraoccipital foramen, like that in certain parrots and pigeons, and which I have pointed out in the Dodo (Zool. Trans. vol. iii. p. 351).

The processes posterior (*p g*) and internal (*g*) to the glenoid articular surface are better developed, especially the internal one in Pl. LXIII., than in the *Tr. niger* (Pl. LX.): the ridge which extends from the ecto-pterygoid (25, Pl. LXIII.) along the inner border of the foramen ovale (*t r*) terminates in *Tr. Gorilla* by an angle or process answering to that called 'styliform' or 'spinous' in Man, but of which there is no trace in the *Tr. niger.*

The palate is narrower in proportion to its length in the *Tr. Gorilla*, but the premaxillary portion (22) is relatively longer in *Tr. niger*. Two anterior palatine foramina, one on each side the almost confluent incisive foramina, are more constant and conspicuous in *Tr. Gorilla*: the posterior palatine foramina are nearer the posterior border of the bony palate in the *Tr. niger*. The pterygoid fossæ (24) are relatively deeper and longer in the *Tr. niger*. The posterior nares are deeper or longer in proportion to their breadth in *Tr. Gorilla*; and the posterior border of the bony palate is emarginate at its middle, instead of being produced backwards into a point as in *Tr. niger*.

As decisive marks of specific distinction as any of those deducible from the forms, proportions and connections of the bones are presented by the greater relative dimensions of the canine and molar teeth, as compared with the incisors in the *Tr. Gorilla*, and by the more complex grinding surface of the last molar (*m* 3, Pl. LXIII.), and its equality of size with the first molar (*m* 1) in *Tr. Gorilla*. The transverse extent of the four incisors of the upper jaw is as great in the *Tr. niger* as in *Tr. Gorilla*: the interspace between the right and left canines is even greater, as is also the extent of the diastema between the canines and the incisors of the upper jaw in *Tr. niger*. The median incisors are, however, larger in proportion to the lateral ones in *Tr. Gorilla*.

In one example of a male *Tr. Gorilla* the antero-posterior extent of the five grinding teeth is 2 inches 8 lines; in a second male it is 2 inches 9 lines; in one male *Tr. niger* the antero-posterior extent of the same teeth measures 1 inch 10 lines; in an older male it measures only 1 inch 9 lines.

The crown of the canine is more inclined outwards in *Tr. Gorilla*; the anterior inner groove is much deeper; the base of the posterior trenchant border is more produced; the ridge between the two inner grooves is more prominent, and the hinder inner groove is continued more decidedly upon the fang in the *Tr. Gorilla*. The following are the dimensions of the canines in the males of the two species:—

	Tr. Gorilla.	*Tr. niger.*
Total length	2″ 8‴	2″ 0‴
Length of the crown	1″ 3‴	0 $10\frac{1}{2}$‴
Breadth of its base	0 10‴	0 7‴
Thickness of ditto	0 $7\frac{1}{2}$‴	0 $5\frac{1}{2}$‴

The last molar (*m* 3) of the *Tr. Gorilla* is more nearly equal to the penultimate one than in *Tr. niger*, being only slightly narrower across the back part: it has the posterior outer cusp, and particularly the posterior inner cusp, much more distinctly developed, and there is a distinct connecting ridge between the posterior outer and the anterior inner cusps, as in the first molar (*m* 1), and which ridge is not developed in the last molar of the *Tr. niger.*

In comparing the interior of the cranium the olfactory fossa is much deeper in the *Tr. Gorilla* than in the *Tr. niger,* and the ' crista galli ' is either more rudimental than in *Tr. niger,* or is absent, and there is no ridge continued upwards from the fossa upon the inner surface of the frontal bone as in *Tr. niger.* The optic chiasma indents the presphenoid with a deeper transverse groove in the *Tr. Gorilla.* The foramen lacerum anterius is subquadrate in *Tr. Gorilla*: it is triangular in *Tr. niger* by the elongation of the upper and outer angle. The roofs of the orbits form a more convex prominence in the interior of the cranium on each side the olfactory fossa in *Tr. niger* than in *Tr. Gorilla.* The posterior clinoid ridges overhang the *sella turcica* in the *Tr. niger,* in which they are more produced forwards than in *Tr. Gorilla.* The fossæ for the middle lobes of the cerebrum or ' natiform protuberances' are deeper in the *Tr. niger* than in the *Tr. Gorilla.*

The inner surface of the cranium of the *Tr. Gorilla* is smooth and even ; the indications of the convolutions of the brain are very feeble ; the middle meningeal artery leaves impressions of its chief ramifications on the sides of the cavity ; the longitudinal sinus begins to indent the inner surface of the calvarium near the end of the sagittal suture, which however was obliterated in all the specimens ; it descends to the middle of the supraoccipital surface, then divides into the lateral sinuses which form deep channels at the back part of the petrosal on the inner surface of the mastoid.

The lateral walls of the cranium formed by the lower borders of the parietals are thin and diaphanous, but compact and without diploë ; this is the case also with some parts of the supraoccipital plate : but the cranial walls are remarkably unequal in thickness ; there is much diploë along the base of the sagittal and lambdoidal crests, and this receives air where it is continued upon the mastoids.

The sinuses of the basisphenoid were divided by a complete septum in one specimen, but this was absent in another ; they extend into the alisphenoids and into the bases of the pterygoids. The frontal sinuses are divided by a strong vertical septum, whence they extend outwards to the base of the external orbitar process ; they also reach far back and communicate, as in Man, with the middle meatus of the nose, above the smaller opening of the antrum.

The inflated or posterior part of the maxillary has thin, almost papyraceous walls : the vast antrum extends to the floor and inner wall of the orbit and into the malar bone ; it communicates with the nostrils by a wide aperture, overarched by the inferior turbinal, and sometimes also by a smaller opening overarched by the turbinal process above. Its walls being broken away on the left side in a skull of an old male *Tr. Gorilla,* shows what appears to be the convex back part of a second wall of the antrum, about half an inch from the outer one, and which is cribriform or reticulate : a portion of this convexity, removed vertically on the right side of the same skull, exposed a light and delicate osseous texture of two kinds; the upper half was finely but irregularly spongy, and this terminated halfway down the mass by a compact, thin surface or floor, convex downwards and backwards, from which a vast number of delicate bony plates and threads proceeded vertically to it, from $5'''$ to $8'''$ in length: they interlaced together as they diverged, and expanding and uniting at their extremities, formed the reticulate inner convex plate of the antrum above described: an interspace extends between this plate and the alveoli of the teeth.

The posterior part of the malo-maxillary suture is finely and deeply indented: the zygomatic suture is beautifully crenulate, so likewise is the infraorbital part of the malo-maxillary suture. The margins of the expanded part of the nasals are joined to the maxillaries and intermaxillaries by true sutures, not harmoniæ, as in the *Tr. niger* and in Man.

As the male *Troglodytes Gorilla* differs from the male *Troglodytes niger* in the superior development of the sagittal crest, so the female *Tr. Gorilla* differs from the female *Tr. niger* in the nearer approximation of the temporal ridges, which meet along the sagittal suture instead of being separated by a smooth tract of between one and two inches in breadth as in the female *Tr. niger*; a difference which indicates a corresponding superiority of size of the temporal muscles in the female of the larger species as compared with the smaller species of Chimpanzee to that which obtains in the males of the two species.

The lambdoidal crista is also more developed in the female *Tr. Gorilla* than in the female *Tr. niger*, and the occiput is flatter and broader. The *os frontis* is flatter behind the prominent supraciliary ridge, and the convexity of the calvarium rises more gradually and remotely from the ridge.

The zygomata offer the same relative superior depth and strength, the same equality of the squamosal portion, and the same elevation and convexity of its upper border. The malar bones show the same superior prominence; the spheno-maxillary fissure the same greater length, narrowness, and nearer approach to a vertical direction.

The maxillo-premaxillary sutures have the same degree of persistency in the adult female *Tr. Gorilla*, being obliterated both upon the face and palate only near the openings of the contiguous alveoli, and demonstrating the same upward extension and triangular expanse of the premaxillary bones, above the nasal aperture, which distinguishes the male *Tr. Gorilla* from the same sex in the *Tr. niger*. The bony palate shows the same superior length as compared with breadth, and the same difference in the relative position of the postpalatine foramina and in the form of the posterior border, as have been noticed in the male skull. There are two small tuberosities between the postpalatine foramina in *Tr. niger*, one on each side of the median suture, but there is no trace of such in the female or the younger male of the *Tr. Gorilla*. The alveolar parts of the premaxillaries have the same relative shortness as compared with the female *Tr. niger*. Although the canines exhibit the same sexual inferiority of size in the female

Tr. Gorilla as in that sex of the *Tr. niger*, the incisors are proportionally to those in *Tr. niger* as much smaller, and the molars as much larger, as in the male *Tr. Gorilla.* The last molar not only shows the same equality of size as in the male *Tr. Gorilla*, but in the skull of the female here described presents a greater complexity of the crown by the outer and posterior lobe being notched, so that the outer half of the wisdom-tooth is here trilobate.

The infraorbital canal is short, wide and shallow, the *foramen lacerum anterius* subquadrate, and the olfactory fossa as deep and well-defined in the female as in the male *Tr. Gorilla.* In short, all the distinctive characters of the species afforded by the disposition of sutures, forms of foramina, and proportions of bones and teeth, are as well-marked in the comparison of the skulls of the females of the two species as in that of the males: in such modifiable characters as the bony ridges dependent upon muscular development we find a more marked distinction in the female *Tr. Gorilla*, as compared with the female *Tr. niger*, in the presence of a ridge, the parietal one, *e. g.*, which does not exist in the female of the smaller species of Chimpanzee at any age.

Even in the female *Tr. Gorilla*, in which the apices of the tubercles of the teeth are but slightly abraded, the temporal ridges have met along the whole line of the sagittal suture, where a narrow groove indicates their original distinction. In one old male of the *Tr. Gorilla* the temporal ridges, though confluent along their bases, diverge as they rise and form two parallel parietal cristæ, divided by a deep angular channel. Amongst other varieties noticeable in the series of skulls of this remarkable species, I may mention the existence of a venous foramen in each squamosal of the female skull, situated about ten lines above the *meatus auditorius*: the infraorbital foramen is double on one side and single on the other in two of the skulls.

With regard to varieties in the skulls of the adult *Tr. niger*, I have seen in one old male three anterior condyloid foramina on each side instead of the normal single foramen; and in the same skull the middle of the basioccipital was perforated from above obliquely downwards and forwards by a canal, probably venous, of two lines in diameter.

On a review of the differences pointed out in the preceding comparisons, the stronger zygomatic arches, with the more developed sagittal and lambdoidal crests, might be viewed as adaptive developments concomitant on the presence of larger canines, and indicative of a larger and more powerful variety of Chimpanzee; but the larger proportional molars and the smaller proportional incisors, the more equal and complex ultimate molar tooth, together with the prominence—slight as it is—of the nasal bones at their median line of coalescence, and above all, the reappearance of the premaxillaries upon the face above the nostril with their longer enduring sutures, constitute a series of differential characters of more importance than such as are due to greater bulk or activity of muscles, and not to be explained by the operation of external circumstances favouring greater general development of size and power. These characters, also, repeated in both the male and female, leave no alternative, according to the value given to such characters in other Quadrumanous genera, than to pronounce the *Troglodytes Gorilla* to be distinct from the *Troglodytes niger*, and this to be, as the *Pithecus Morio* is to the *Pithecus Wurmbii*, a smaller, feebler and more anthropoid species of its genus.

Having thus pointed out the particulars in which the *Troglodytes Gorilla* differs from the *Tr. niger*, I proceed next to compare the larger and more formidable species of Chimpanzee with its Asiatic analogue, the great Orang or Pongo of Wurmb, *Pithecus Wurmbii.*

§ 5. *Comparison of the Skull of the male* Troglodytes Savagei *with that of the male* Pithecus Wurmbii.

In size, these most powerful and formidable examples of the Quadrumanous order are nearly equal; the great Chimpanzee upon the whole, however, surpasses the great Orang, and therefore claims to be regarded as the giant of the Quadrumanous order. Both are alike remarkable for the superior development in the male sex of the conical canines and the strong carnassial-like sagittal and lambdoidal crests, and the massive zygomatic arches and malar bones. In both the facial angle is low and brutal, the few degrees in favour of the Chimpanzee being due to the enormous supraorbital ridge characteristic of its genus*. This is the first and most striking feature of distinction between the two great Apes; and while its presence impresses a peculiarly forbidding, scowling physiognomy even upon the dry skull of the great Chimpanzee, its absence gives a more open and milder aspect to that of the slothful Orang.

The cranium is absolutely longer in the Chimpanzee, and longer in proportion to the face: the lambdoidal crista is more developed, especially at its upper and middle part, where it is joined by the sagittal crest. The upper border of the squamosal is longer and straighter in the Chimpanzee, and joins the frontal: in the Orang it is commonly separated from the frontal by the broader alisphenoid. The zygomatic arch is deeper and stronger in the Chimpanzee, the zygomatic portion of the arch is shorter and its upper border is convex or angular, whilst in the Orang it is longer, more slender, and its upper border is straight. The outer boundary of the orbit is much thicker. The spheno-maxillary fissure is much longer in the Chimpanzee; in the great Orang it is very short, but wider.

The line of the external border of the orbit and of the posterior contour of the maxillary bone is less oblique from above downwards and forwards in the Chimpanzee than in the Orang: the alveolar border of the maxillary, especially its molar part, is longer in the Chimpanzee: instead of the rough oblong tract upon the mastoid, there is the distinct hemispheric mastoid process in the great Chimpanzee. Such are the chief differences in the comparison of the side views.

* Compare Pl. LXI. with Pl. XXXI. p. 192. vol. ii.

Viewed from before, the enormous supraorbital arch with the tumid malar bones again form the most striking characteristic of the Chimpanzee: the orbits are sub-quadrate with the angles rounded off; in the Orang they are full ellipsoids with the long diameter vertical. The zygomata are more directly continued backwards from the malars, which contribute a larger proportion to the arch in the Chimpanzee, whilst in the Orang they curve more outwards. The flat and narrow nasal of the Orang contrasts strongly with the form of the same bone, which is prominent above and expanded below, in the Chimpanzee; and the oval nostril, contracted above in the Orang, equally contrasts with the full elliptic nostril in the Chimpanzee. The alveolar portion of the premaxillaries is longer in the great Orang than in the great Chimpanzee, and, with the canine-alveoli, this part of the face is broader as well as more prognathic in the great Orang. The malar process of the maxillary is shorter in the Orang; it is more deeply impressed outside the socket of the canine, and the inferior angle at its junction with the malar is more produced downwards: the suborbital outlet is more constantly divided into two or three foramina in the Orang.

In the basal view the occipital region is both broader and flatter in the great Chimpanzee; it approaches Man nearer in the minor degree of its inclination from the horizontal plane of the basis cranii, in the more advanced position of the condyles and zygomatic arches, by the shorter extent of the basioccipital and basisphenoid, and by the greater concavity of the glenoid fossæ for the lower jaw. The occipital condyles are less convex in the Chimpanzee and somewhat smaller than in the Orang; they appear therefore disproportionately small as compared with the size of the skull, which is poised by them upon the atlas. The basioccipital is narrower and more convex anteriorly in the Chimpanzee.

The precondyloid foramen, which is usually single in the Chimpanzee, opens immediately below—almost into—the jugular foramen; whilst in the Orang, in which there are usually two precondyloid holes, the exoccipital extends forwards and outwards a quarter of an inch beyond them before it forms the posterior border of the jugular foramen.

The processus jugularis of the exoccipital is longer and more curved forwards in the Orang, and the rough ridge representing the paroccipital process is better developed: the form and extent of the jugular process (*j p*, Pl. LXIII.) in the Chimpanzee is more like that in Man.

The angular process of the petrosal (*p j*) encroaching upon the foramen jugulare is more developed in the Chimpanzee, and more resembles that in Man.

The carotid foramen is more oblique, being defended by a ridge along its outer side in the Chimpanzee answering to that continued from the vaginal process in Man; there is no such ridge in the Orang.

The eustachian process (*e*) of the petrosal is much thicker and less sharply pointed in the Chimpanzee; the apex of the petrosal itself is also thicker and less pointed.

Between the foramen caroticum and the foramen stylo-mastoideum in the Chimpanzee, there is a deep stylohyal fossa (38, Pl. LXIII.) answering to the root of the stylohyal in Man ; this is less deep and less constant in the Orang.

The mastoids are relatively larger in the Chimpanzee, and develope a true process instead of a rough oblong tract.

The glenoid articulation of the squamosal is more concave, especially from side to side, in the Chimpanzee, and it rises above the level of the tympanic meatus. In the Orang the surface is almost flat, and is carried below the level of the auditory process; the inner process of the glenoid cavity is wanting in the Orang, but the hinder one is as large as in the Chimpanzee.

In the Chimpanzee a styliform process of the sphenoid (6 *s*) abuts against the inner glenoid process (*g*), and is wedged between this and the eustachian process (*e*) of the petrosal. In the Orang the styliform process is absent.

In the Chimpanzee the pterygoids are narrower than in the Orang, the external plate is less developed, and the internal plate is thicker and shorter: a ridge is continued from the base of the external plate into the styliform process in the Chimpanzee: the pterygoid fossa is deeper and longer in the Orang.

The posterior nostril is shorter and wider in the Chimpanzee.

The bony palate is longer and shallower in proportion to its width in the Chimpanzee; it is more expanded anteriorly in the Orang. In the Orang the two posterior palatal foramina are nearer each other, and have two tuberosities between them; these are absent in the great Chimpanzee. The prepalatal foramen is larger and more distinctly divided in the Chimpanzee. There is a moderate-sized foramen on each side nearly in the line of the obliterated premaxillary-palatine suture, the course of which is marked by two or three small foramina in the Orang.

The incisors are thicker from before backwards in proportion to their breadth in the Orang than in the Chimpanzee.

The interspace between the incisors and canines is narrower in the Chimpanzee, but the canines have longer and broader crowns in the Chimpanzee.

The outer lobe of the first premolar, *p* 1, is larger than the inner one, and *vice versâ* in the second premolar, *p* 2, in the Chimpanzee: the outer lobe of *p* 1 is a little larger than the inner one, and both lobes are equal in *p* 2 in the Orang.

The antero-posterior diameter of the true molars is greater in comparison with the transverse diameter in the Chimpanzee than in the Orang, and the last molar is more equal in size and similar in structure to the others; hence the longitudinal extent of the series of grinding teeth, including the premolars, is longer; the five teeth in the Orang equalling only the last four teeth in the Chimpanzee.

The structure of the grinding surface of the true molars is so modified in the Orang as to deviate further from that in Man than it does in the Chimpanzee: both the first and second true molars have the four principal cusps in the Orang, but they are less developed: the oblique ridge joining the antero-internal to the postero-external cusp is wanting. The sigmoid course of the prominent part of the enamelled surface resulting from this ridge is a material mark of the closer affinity of the Chimpanzee to Man. The whole grinding surface of the crown is more minutely wrinkled in the Orang. The number of roots of both premolars and molars is the same in both Apes.

The skulls of the great Chimpanzee and Orang offer very striking differences from one another when viewed from above, looking down upon the vertex. The cerebral dome is more prominent, and the chamber of the brain seems at first sight to be more capacious in the Orang; but it is not so absolutely, being only less masked by the lambdoidal and supraorbital ridges than in the Chimpanzee, in which their extraordinary development, with that of the base of the zygomata, changes the convexity of the outer surface of the cranial dome into a concavity at its periphery: the anterior and posterior parts of the calvarium are rendered broader in the Chimpanzee, the external orbital processes are much stronger, and the whole cranium is both longer and larger in proportion to the face. The supraorbital prominence renders the plane of the orbits more vertical in the Chimpanzee, and a less proportion of these cavities is visible in the top view than in the Orang.

The means of comparing the lower jaw and teeth of the *Troglodytes Gorilla* of Africa and the *Pithecus Wurmbii* of Borneo have not yet reached me.

In the foregoing comparison the points in which the *Troglodytes Gorilla* offers a closer resemblance to Man than the *Pithecus Wurmbii* does, are the following:—

1. The cranial part of the skull is larger in proportion to the facial part.

2. The foramen magnum is more advanced, and its plane bends upwards two degrees less from that of the basioccipital than it does in the Orang.

3. The plane of the supraoccipital* forms an angle of 120° with that of the basioccipital: in the Orang it forms an angle of 140°.

4. The mastoid processes are convex cellular protuberances; but in the Orang they are rough ridges.

5. The precondyloid foramen is single on each side, and opens closer to the jugular foramen.

6. The presence of a vaginal process.

7. The presence of a styliform process of the sphenoid.

8. The shorter basioccipital and basisphenoid.

9. The deeper glenoid cavities for the lower jaw.

10. The wider posterior nares.

11. The shorter and straighter zygomatic arches.

12. The foramen ovale is completely perforated in the alisphenoid, but in the Orang it is a notch, completed behind by the petrosal, and is of a longer and narrower form.

* A line drawn from the back part of the foramen magnum to the spinous process at the middle of the lambdoidal ridge crossing the line drawn along the basioccipital.

13. The alisphenoid extends outwards more beyond the ecto-pterygoid before it ascends upon the side of the cranium.

14. The greater length of the spheno-maxillary fissure.

15. The more outward development of the malar process of the maxillary.

16. The squarer form and less oblique plane of the orbits.

17. The prominence of the upper half of the nasal bones.

18. The narrower and less produced muzzle (alveolar part of premaxillaries and contiguous parts of maxillaries lodging the canines).

19. The absence of orbito-malar foramina.

20. The greater breadth of the interorbital space. The smaller size of the orbito-sphenoids (lesser alæ of the sphenoid). The greater development of the frontal sinuses.

21. The greater breadth of the sella turcica and the wider separation of the optic foramina.

22. The minor convexity of the roofs of the orbits at the sides of the olfactory fossa.

23. The ento-jugular process of the petrosal, and the size, shape and position of the aquæductus vestibuli with its overhanging plate.

24. The configuration of the grinding surface of the premolars and molars.

The *Pithecus Wurmbii* more nearly resembles Man:—

1. In the greater relative extent of the convex part of the calvarium.

2. In the minor prominence of the supraorbital ridges.

3. In the greater length and breadth of the upper part of the alisphenoids, which more commonly join the parietals than in the Chimpanzee.

4. In the greater proportion of the orbital plate of the sphenoid, and the less proportion of that of the malar.

5. In the larger size and squarer form of the lachrymal, which joins more constantly and to a greater extent the os planum (orbital part of prefrontal).

6. In the greater length and depth of the pterygoid fossæ.

7. In the triangular form of the fissura lacera anterior.

8. In the deeper fossæ for the natiform protuberances.

9. In a minor development of air-cells in the squamosal and alisphenoid.

These characters of nearer approach to Man, besides being fewer in number, are of less importance in the Orang, since they depend for the most part on the inferior development of characters which are nevertheless present, and which are strictly apish, distinguishing both the large anthropoid species from Man, and only not equally so, because they are present on a larger and more decided scale in the skull of the Chimpanzee, and give it a more brutish and forbidding physiognomy.

§ 6. *Comparison of the Skull of the male* Troglodytes Gorilla *with that of a male Negro.*

In the side view the most remarkable difference is the small proportional size of the cranium, as defined by the supraorbital ridge and the zygomatic arch from the facial part of the skull, in the Chimpanzee; notwithstanding the presence of the strong sagittal and lambdoidal cristæ which are superadded to the cranial part of the skull, and prolong its extent upwards and backwards beyond the proper walls of the brain-case in the great Ape.

The temporal ridge, arching upwards and backwards, and blending with its fellow to form the parietal crest, defines the upper contour of the cranium in the Chimpanzee, the intercepted part of the frontal sinking below the converging ridges and forming a concavity in their interspace. In Man the frontal swells out into a broad convexity between those ridges, which are feebly defined by the slight subsidence of the muscular temporal surface below the level of the rest of the frontal, and this indication of a ridge usually disappears before it reaches the coronal suture, where nearly the whole upper surface of the cranial dome intervenes between such indications.

The rudiment of the lambdoidal ridge in Man curves with the convexity upwards below the suture to terminate in the occipital spine or tubercle, a free tract of bone more than an inch in breadth dividing the lambdoidal from the temporal ridges, and being continued between them upon the mastoid process. In the Chimpanzee the enormous lambdoidal crest, blended with the back part of the temporal ridge, curves with the concavity upwards, as it extends from the mastoid, obliterating the suture, to join the hind end of the sagittal crest; and the lambdoidal crest terminates the contour of the cranium behind as the sagittal does above.

In Man the parietal dome rises high above and the occiput swells out below the rudimentary lambdoidal ridge, whilst the larger and longer mastoid process, projecting downwards and extended forwards beneath the meatus auditorius externus, supports the vaginal plate of the tympanic or auditory process; but in the Chimpanzee the tympanic or auditory process, presenting the form of a semicylindrical tube, is wholly in advance of the shorter mastoid process, and has no vaginal process at its outer end. The post-glenoid process of the squamosal (middle root of the zygoma) is relatively thicker and longer, but more obtuse in the Chimpanzee.

The zygoma is not only much stronger, but the squamosal and malar portions have different forms and proportions in the Chimpanzee; the squamosal is as deep and as long as the malar part, instead of being shallower and longer as in Man; and its upper border rises in the Chimpanzee into an angular form. The malar portion is accordingly longer, and does not decrease in depth after leaving the body of the bone as in Man. The posterior border of the frontal process of the malar is slightly concave or nearly straight in the Chimpanzee; it forms a strong sigmoid curve in Man, convex backwards at its upper half. The supraorbital ridge projects very slightly beyond the slope of the frontal between the external angle and the prominent sinus even in the lowest Negro or Australian skull: the prominence of the whole supraorbital ridge, which is the characteristic of the genus *Troglodytes*, reaches its maximum in the present great species, and forms the most marked distinction in the comparison of its skull with that of Man. The interorbital part of the ridge, however, projects more suddenly over the root of the nasal in the Ethiopian and especially Australian skulls than in the Chimpanzee. But even in the low race of Man selected for the comparison, the development of the prosencephalon carries the interorbital part of the frontal forward so as to bring the orbital cavity into view in advance of its lateral malar boundary; but no part of that cavity is seen in the same direct side view in the Chimpanzee.

The prominent nasal bone forms part of the anterior outline below the overarching frontal in Man; but notwithstanding the characteristic projection of the nasal in the great Chimpanzee, the thick swollen external wall of the orbit shuts it out of view. Below the malar the alveolus of the great canine in the maxillary, and then the prominent premaxillary and incisors, complete the anterior contour in the Chimpanzee; but in Man the concave maxillary border of the external nostril leads from the nasal to the short and slightly projecting anchylosed premaxillary bone, supporting the almost vertical crowns of the incisors.

The great cuspidate canine, the interval dividing it from the incisors, the superior size of the first premolar over the second, the prominent double socket for the two diverging external fangs of each premolar, and the equal-sized true molars, are all distinctive characters in the Chimpanzee of the most decisive nature in contrast with the specific peculiarities of the dentition in Man.

In the direct side view of the human skull, a part only of the crown of the outer incisor and scarcely any of the inner incisor can be seen projecting beyond the canine; whilst the whole crown of the outer incisor and the more prominent part of the inner incisor extend beyond the canine in the Chimpanzee. The whole alveolar border of the upper jaw extends much further below the base of the cranium in the Chimpanzee than in Man, in whom the superior depth of the brain-case brings the mastoid process almost on a level with the alveoli of the maxillary bone. The relatively shorter, deeper, subquadrate form of the upper jaw is also a marked characteristic of Man. In the Chimpanzee, although the alveolar border forms a right angle with the posterior border of the upper jaw, the long anterior border slopes forwards towards the lower border at an acute angle, and to the same degree departs from its parallelism with the posterior border.

The spheno-maxillary fissure is longer, narrower and less curved in the Chimpanzee than in Man: the ectopterygoid is shorter, but the antero-posterior extent of the base of this process is relatively much greater. The styliform process of the sphenoid terminates the arch behind the pterygoid in both; but the vaginal process with its anchylosed stylohyal is a character quite peculiar to the human skull.

Another feature peculiar to Man is the arch or upward curve of the basal contour of the cranium between the occipital condyles and the lower end of the posterior border of the vomer, and the near approach to parallelism of the line of the occiput below the superior transverse ridge with the line of the teeth. The difference in the plane of the occipital foramen of the human skull from that in the Chimpanzee is as well-marked in the lowest as in the highest races of Man.

Such is the enormous development of the facial part of the skull as compared with the cranial part in the Chimpanzee, that in taking a direct front view with the nasal cavity as the centre of the perspective plane, little more of the cranium is visible than that which forms the base of the sagittal crest (Pl. LXII. 7). The thick supraorbital ridge (12) and outstanding malars (26) and maxillaries (21) compose the major part of the plane, and the prognathic premaxillaries (22) and incisors with the great canines and their tumid alveoli complete with the broad and deep lower jaw the view below.

In Man the upper half of the corresponding view is formed by the frontal part of the cranial dome; the expanded sides of that dome are visible behind and beyond the outer walls of the orbits, and the mastoid processes come into view behind the angles between the malars and maxillaries. Of the regular arch formed by the equable teeth only the hinder molars are excluded from view, and not always these in the white races.

The prominence of the entire nasal bones; the relatively larger, broader, and more sharply defined orbits; their comparatively slender outer boundaries; the concavity of the surface which descends from the orbit to the alveoli of the premolars in contrast with the convexity of the same part in the Chimpanzee; the vertical plane of the nasal aperture (which slopes from above downwards and backwards in more favoured races of Man); and the slight prominence of the premaxillaries (which are vertical in well-formed Caucasian skulls), are eminent characteristics of the human species in this comparison.

In the orbits of the Chimpanzee the lachrymal bones are either separated from the 'ossa plana' or are united to them in a much smaller proportion than in Man; and the orbital plate of the lachrymal is much smaller as compared with the part excavated for the lachrymal fossa than it is in Man. The entorbital angle or plate of the malar is longer and extends deeper into the orbit than in Man.

In a comparative view of the skulls from above, in which the beginning of the sagittal suture is the centre of the perspective plane, scarcely anything is seen but the smooth expanded vault of the cranium in Man; the narrower temples of the Negro and Australian allow the zygomata to come into view, and in the most prognathic examples the incisors just appear between the prominences of the frontal sinuses.

In the Chimpanzee the whole length of the face from the lower border of the orbits is seen sloping from beneath the supraorbital ridge; the whole span of the large zygomatic arches, with parts of the temporal fossæ, appear at the sides of the narrower temples; the oval cranial vault after a certain expanse changes its curve, and from being convex becomes concave, expanding into a broad base formed by the supraorbital ridge in front and by the lambdoidal crest behind, continued into the zygomatic arches at the sides. The small cranial dome also supports the strong sagittal crest which at the coronal suture divides and diverges, curving outwards to the external angles of the supraorbital ridge.

No quadrumanous animal, and few other mammals, offer a greater contrast with Man in the form and structure of the upper surface of the cranium than the great male Chimpanzee does.

In the basal comparison of the skulls most of the differences pointed out in my former memoir between the *Troglodytes niger* and Man are repeated, but are the more striking as being presented on a larger scale by the *Troglodytes Gorilla.* As a consequence, however, of the enormous development of the lambdoidal crest, which carries further backwards and outwards the flattened occipital region, the foramen magnum appears to be more advanced in position than in the *Troglodytes niger*; but this seeming nearer approach to the human structure disappears when the base of the skull is viewed in true perspective, placed upright with the palatal surface perpendicular, as in Plate LXIII.

The basioccipital ($\overline{1}$) is longer, thicker vertically, flatter below, and broader in front than in Man; it sends out short precondyloid processes or prominences into the jugular foramina (*j*) on each side; these are overlapped by the synonymous processes (*p j*) of the petrosal anterior to the precondyloid holes (*p*): the basioccipital does not anchylose with the basisphenoid; both extend straight forwards, parallel to the plane of the palate, instead of curving from below upwards and forwards as in Man. The *fissura lacera media* (*f*), which divides the basioccipital from the petrosal (16), is longer and narrower, and does not expand at its fore-part: the posterior border of the basioccipital becomes less expanded where it joins the condyles.

The occipital condyles (2') are much smaller compared with the size of the skull than in Man; they are also less convex and more rounded at their extremities; they are wider apart, and their axes diverge at a more open angle from before backwards. The posterior condyloid fossa (*c f*) extends forwards along the outer side of the condyle to the jugular process (*j p*); in Man it usually terminates in a post-condyloid foramen, and is filled up by the rough paroccipital ridge which sometimes developes a small (paroccipital) process; this is represented by a feeble tuberosity below the jugular process (*j p*) in the Chimpanzee, in which there are no post-condyloid holes. The sutures between the exoccipitals (2) and mastoids (8) remain, but the rest of the lambdoidal suture is obliterated in the Chimpanzee: the extent of the exoccipitals outside the condyles is less than in Man.

The supraoccipital (3) is a much broader plate than in Man, and is flat or slightly concave externally, with all trace of the superior angle lost in the anchylosis consequent on the development of the great lambdoidal ridge: it shows nothing answering to the crucial ridge or spine of the human convex occiput, except, in some skulls, the vertical ridge dividing the great subconcave expanse.

The basisphenoid (5), besides its non-confluence with the basioccipital, has a larger extent uncovered by the vomer and by the bases of the anchylosed alisphenoids (6) and pterygoids (24): it is excavated by large sinuses extending into both the alisphenoids and pterygoids: the sinuses are confined to the basisphenoid and presphenoid in Man.

The broader pterygoids in the Chimpanzee anchylose with and, as it were, embrace a greater part of the base of the alisphenoid: the foramen ovale (*t r*) is more remote from the foramen caroticum, and is pushed by the broad ectopterygoid (25) further back from the pterygomaxillary fissure (*s p*): the extent of the basis cranii between the carotid foramen and sphenomaxillary fissure being twice that in Man. The styliform process (6 *s*) is less developed, and the inner border of the glenoid cavity (*g*) of the squamosal abuts against its whole length, or even extends below or beyond it.

Outside the pterygoid the alisphenoid (6) becomes narrower, and is continued more directly upwards into the temporal fossa than in Man: the ectopterygoid ridge (25) is less developed, and the fossa on the outer side of the ectopterygoid is not present, or is very feebly developed. The alisphenoid contracts instead of expanding as it rises, terminates before it gains half the height of the orbit, and is excluded from junction with the parietal by the meeting of the squamosal with the frontal. The expanded spine (Pl. LXI. 7) of the parietal vertebra is thus entirely separated from its neurapophyses (6) in the Chimpanzee. In the Australian the alisphenoid ascends higher than the malar, but not so far as in the European. Besides the relatively smaller size of the parietal bones, the early obliteration of the sagittal suture, and the development of the crista upon it, the lower border of the parietal is straighter than in Man and more equally divided between the squamosal and the mastoid. The diploë is obliterated at the middle of each parietal in the Chimpanzee.

The presphenoid, where it forms the seat of the optic chiasma, is not defined, as in Man, by the abrupt excavation of the sella behind it; but the sphenoidal cells raise the floor of the sella to a level with the chiasmal platform into a convexity which gradually sinks as it recedes into the hollow of the sella, which is shallower than in Man, and the longitudinal diameter is greater than the transverse one. If the sella or space between the anterior and posterior clinoid processes be divided into a convex chiasmal and a concave pituitary part, these are more equal in the Chimpanzee than in Man.

The orbitosphenoids coalesce nearer their origin with the orbital plates of the alisphenoid, obliterating the fissure which in Man is continued outwards from the 'foramen lacerum anterius;' so that this foramen is better defined and has a subquadrate form in the Chimpanzee; and there are no ridges, called 'lesser alæ,' defining the fossa of the anterior lobe from that of the middle lobe as in Man. The suture between the orbitosphenoids and the frontals is quite obliterated in the Chimpanzee. A short triangular plate divides the optic hole from the foramen lacerum anterius on each side, which plates answer to rudiments of the 'alæ minores' and to the bases of the anterior clinoid processes, but those processes are not extended backwards as in Man. The foramen rotundum is closer to the foramen lacerum anterius than in Man, and the styliform foramen (*s t*) is closer to the foramen ovale (*t r*).

The mastoid bone (Pl. LXIII. 8 *m*) is relatively larger, but developes a smaller and more hemispheric mastoid process (*m*). Traces of the suture between the mastoid and squamosal continue longer in the Chimpanzee than in Man. Its upper part extends outwards into a strong angular ridge, and its under part extends from the process inwards as a horizontal plate (8) to join the exoccipital, which plate is of greater extent than in Man, and is not grooved by the digastric muscle; thus the space between the occipital foramen (*o*) and the external auditory foramen (*a u*) is considerably greater in the Chimpanzee than in Man. The stylomastoid foramen (*s m*) is exterior to the stylohyal fossa (38), not directly behind it as in Man, in whom the stylohyal bone becomes anchylosed at maturity with that fossa and forms the so-called 'styloid process of the temporal.' There is but a rudiment of the vaginal process (*v*).

The tympanic (28), which anchyloses with mastoid, squamosal and petrosal as in Man, is of greater length than in Man: it forms no part of the glenoid fossa, which is divided from it by the post-glenoid process, and the rudiment of the 'fissura Glaseri' is quite behind the glenoid fossa in the Chimpanzee, whilst in Man, from the different relative position and shape of the tympanic or auditory process, the 'fissura Glaseri' is described as dividing the glenoid fossa transversely. The inner termination of the meatus auditorius is very obliquely cut off, but in a different direction from that in Man; in him it is from behind inwards and forwards, the anterior wall of the meatus being longer than the posterior one. In the Chimpanzee the inner end of the meatus is cut off obliquely from above inwards, downwards and forwards: at the beginning of the meatus its vertical diameter is greatest, but as it penetrates the cranium the transverse diameter becomes greater, the depth decreasing, and it rather suddenly expands at its inner very oblique termination.

The superior size of the parapophyses of the middle cranial vertebra* in Man relates to the greater amount of muscular action required for the support and movements of the skull, which is so nicely and peculiarly balanced upon the erect vertebræ of the trunk: in the Quadrumana, where the skull is thrown more forwards, its support is derived more from the action of the great nuchal muscles inserted into the occiput than from that of the sternomastoids; but we may infer, from the nearer approach which the *Troglodytes Gorilla* makes to Man, in comparison with the *Troglodytes niger*, or with the known species of Orang, in regard to its mastoid processes, that it assumed more nearly and more frequently the upright attitude than the inferior anthropoid Apes do.

* The arguments in proof of this general homology of the mastoids will be found in my work on the 'Archetype of the Vertebrate Skeleton,' 8vo, pp. 29, 110, 120, 131.

The air-cells, which are confined to the mastoid in Man, extend in the Chimpanzee into the squamosal, inflating it above the base of the zygomatic process, and as far forwards as its junction with the frontal, where the squamosal sinuses are contiguous to, though they seem not to communicate with, those of the alisphenoid.

The petrosal (Pl. LXIII. *p j*, 16) is larger in the Chimpanzee than in Man; its antero-posterior diameter especially is greater: its eustachian process (*e*)* is much more developed and more distinct from the proper apex (16) of the petrosal, which is less jagged than in Man, and rests more completely upon the base of the alisphenoid, almost filling up the vacuity called 'foramen lacerum medius' in Man. The carotid foramen (*c*) is smaller than in Man; it is defended by an angular ridge (*v*) externally, which divides it from the stylohyal fossa (38) in the Chimpanzee, and is the sole representative of the vaginal process: the prejugular (*p j*) process from the inner side of the foramen caroticum abuts upon a corresponding process of the basioccipital, and with it forms the anterior boundary of the foramen jugulare (*j*).

The intracranial part of the petrosal is relatively shorter in the Chimpanzee than in Man: its upper surface is more even: the channel of the lateral sinus which defines it behind is narrower. The foramen auditorium internum has not the overhanging ridge; the superior ridge is not grooved by the petrosal sinus.

The chief characteristics of the frontal, due to its smaller size and the supraorbital ridge, have already been noticed: besides these deviations from the human type, the ectorbital processes stand further out before they bend down to join the malar, and the postorbital angles descend much lower into the temporal fossa and form a longer wedge between the alisphenoid and malar bones, the point terminating on a level with the floor of the orbit.

The vomer (13) is deeper and more oblique than in Man, and does not reach so far forwards.

The coalesced prefrontals (*laminæ mediæ æthmoidei*) are connate, as in Man, with the olfactory capsules forming the æthmoidal cells, the superior turbinals, the 'partes planæ' and the cribriform plate, but they do not extend backwards to form a 'crista galli.' The cribriform plate is much smaller, and is sunk into a deep (rhinencephalic) fossa.

The palatines (20) form a smaller proportion of the bony palate; their mesial anterior ends advance forwards in a point between the maxillaries, but the mesial posterior ends, which project backwards in a point in Man, are truncate, and the border of the bony palate there presents either a shallow median emargination, between two slighter ones, or the whole posterior boundary (in the younger male) is slightly undulated with a general curve concave backwards; whilst in every variety of the human race the same border presents two lateral concave emarginations divided by the median point. The posterior palatine foramina (20) are close to the anterior palato-maxillary suture:

* This process may belong to the tympanic rather than to the petrosal.

in Man they are nearer the posterior border of the palate. The pterygoid and orbital relations of the palatal bones resemble those of Man.

The maxillary bone, besides its greater relative size, has a relatively longer and shallower palatal portion without any median convexity: it is more expanded anteriorly, instead of being contracted between the premolars: its malar process is considerably deeper, and is perforated by the maxillary or suborbital nerve at a greater distance below the orbit: the single foramen for this nerve is the rarer variety than the double one in the Chimpanzee: the most decisive distinction from the Human type furnished by the maxillary bone in the present comparison is its exclusion from the nostril by the elongation of the premaxillary and the interposition of the upper angle of that bone between the maxillary and the nasal in the large species of Chimpanzee. The double fangs of the premolars render the alveolar border or 'process' of the Chimpanzee's maxillary bone more complex than it is in Man; and it is tumid, and produced anteriorly by the sockets for the enormous canines.

The premaxillaries differ from those of Man by their vastly greater proportional size, their greater prominence, the longer persistence of their sutures with the maxillaries and their nasal processes (Pl. LXII. 22'). The extent of their palatal part (Pl. LXI. 22) removes the prepalatal foramina further back from the alveoli, and these foramina are double, or not so completely blended into a single hole below, as in Man. Their median suture with each other, instead of being supported on a prominent ridge at the anterior surface of the bone, as in Man, is sunk into a smooth fossa, and the nasal ridges for the support of the septum narium commence quite within the nostril behind an arched transverse eminence or bar.

The malar bone, besides its superior relative size, has a more convex exterior surface (26), which is turned more towards the front of the face than in Man: the line of the malomaxillary suture descends more directly downwards and outwards; in Man it extends more outwards before it descends, the suborbital angle of the malar being longer, more slender and pointed than in the Chimpanzee; the orbital margin is sharp in Caucasians, but is rounded off in Australians. The posterior border of the ectorbital or frontal process (Pl. LXI. & LXII. 26') is straight at its commencement, not convex as in Man: the entorbital plate of the malar extends further backwards, and unites in a smaller proportion with the alisphenoid than with the frontal; it is imperforate. The zygomatic suture is a regular or slightly wavy oblique line, not made angular or curved by a sudden notch in the upper part of the zygomatic process of the malar, as in Man.

The zygomatic portion of the squamosal equals in depth the malar portion of the arch, and is not shallower, as in Man: the post-glenoid process (Pl. LXI. *p g*) is stronger and projects down more freely, and relatively lower as respects the tympanic. The squamous plate (27) is lower and more angular in the Chimpanzee; its upper border, which does not rise higher than opposite the middle of the orbit, being almost straight; the continuation of the line of this border by the mastoid makes the squamosal appear much longer from before backwards than this temporal element really is. In Man the mastoidal element developes no continuation of the squamous plate, but the hind border of this plate curves down to the place of the primitive suture between the squamosal and mastoid. The whole of the squamosal receives air-cells from the mastoid in the Chimpanzee, and its exterior surface is made convex and, as it were, swollen out by them: no part of the squamosal is so modified in Man*.

At the first view of the skull of the great Chimpanzee, one is struck by its superior size to the human skull, especially its greater length, and the greater breadth of the face and of the occiput: the brain-case is made to appear more contracted in proportion than it actually is, by the superaddition of the enormous intermuscular crests and supraorbital ridge: it would seem, indeed, as if the osseous matter required to form the expanded cerebral chamber in the human skull had been here expended in the formation of the great external crests and ridges. Notwithstanding, however, this superiority of size in certain dimensions, and the apparently massive character of the skull of the great Chimpanzee, it is actually lighter than that of Man. The cranium of the adult male *Troglodytes Gorilla*, figured in Plates LXI. LXII. & LXIII., weighed 1 lb. 7 oz. 8 drs. avoirdupois, whilst the cranium of a male Australian, without the lower jaw, weighed 1 lb. 8 oz. 10 drs. This unexpected result is due to the greater size and extent of the air-cells in the *Troglodytes Gorilla*. The air introduced from the tympanic chamber into the mastoid extends backwards into cells, continued along the base of the lambdoidal crista to its junction with the parietal crista, and from the mastoid forwards, inflating the whole squamosal plate as far as the alisphenoid, which, with the pterygoids, receives air from the sphenoidal sinuses.

The upper part of each sphenoidal cell is divided by a plate of bone entering inwards and downwards from the upper and outer wall and folded round the canal continued from the foramen rotundum, and conveying the second division of the trigeminal nerve to the sphenopterygoid fossa. In Man, the canal continued from the foramen rotundum to the back-part of the orbit does not impress the wall or encroach upon the cavity of the sphenoidal sinus. The sphenoidal sinuses communicate, each by a small round aperture, with the back-part of the superior nasal meatus, as in Man.

The frontal sinuses are divided from each other by a strong median vertical septum, and extend far outwards along the base of the supraorbital crest; they open below into the middle meatus, as in Man. The great maxillary sinus or antrum is chiefly remarkable for its extension upwards, where it swells out the maxillary contribution to the inner wall of the orbit; the nasal aperture of the antrum, of a rounded form and two-thirds of an inch in diameter, is covered by the overhanging inferior turbinal bone: the lachrymal canal terminates at the upper part of the orifice of the antrum, not in advance of it, as in Man.

The osseous parts of the olfactory capsule, which have coalesced with the prefrontals and form the 'superior' and 'middle' turbinal processes of the æthmoid, are present,

* The extension of the auditory cavity into this element of the temporal is found in many Marsupials and Rodents.

as well as the large independent inferior turbinals: these are all longer in proportion than in Man.

The chief differences which the cranium and teeth of the *Troglodytes Gorilla* present as compared with those parts of the Human structure may be summed up as follows:—

1. The smaller proportional size of the cranium.

2. The more backward position of the foramen magnum, and its more oblique plane in relation to that of the base of the skull.

3. The smaller relative size and more backward position of the occipital condyles.

4. The longer basioccipital, and broader, flatter and lower supraoccipital.

5. The longer basisphenoid and shorter alisphenoids.

6. The smaller size of the coalesced parietals, and their separation from the alisphenoids.

7. The conversion of a greater part of the outer surface of the parietals into concavities or depressions for the lodgement of the temporal muscles by reason of the bony crest developed from the line of the obliterated sagittal suture and of the lambdoidal crest.

8. The larger proportion of this crest and of the squamosal plate developed from the mastoid and the smaller size of the proper mastoid process.

9. The smaller size of the vaginal and styliform processes, and the absence of the styloid process, arising from the non-anchylosis of the stylohyal bone.

10. The larger post-glenoid process and the longer auditory process (tympanic bone), with their relative position, one behind, but not below the other.

11. The position of the stronger zygomata opposite the middle third of the basis cranii.

12. The prominent supraorbital ridge.

13. The longer nasal bones, anchylosed together and flattened at their lower half.

14. The greater proportional size and greater prominence of the upper and lower jaws.

15. The longer osseous palate, and the median emargination of its posterior border.

16. The parallelism of the alveoli of the molars and canine of one side with those of the other.

17. The diastema or vacant place in front of the socket of the canine in the upper jaw, and behind that socket in the lower jaw.

18. The larger and more produced premaxillaries; the persistence of more or less of their sutures showing the intervention of their upper extremities between the nasal and maxillary bones.

19. The minor extent of connection of the lachrymal with the 'pars plana' of the æthmoid, or their separation by the junction of the orbital plate of the maxillary with that of the frontal behind the lachrymal.

20. The depth of the olfactory fossa, and the absence or rudimental state of the 'crista galli.'

21. The squamosal, lambdoidal, alisphenoidal and pterygoid air-cells.
22. The more prominent cusps of the molar teeth.
23. The larger relative size and more complex grinding surface of the last molar tooth in both jaws.
24. The larger relative size of the premolars, especially of the first.
25. The more complex implantation of the premolars by three roots, two external and one internal.
26. The much larger and longer canines.
27. The sexual distinction in the development of these teeth.
28. The more sloping position of the crowns of the incisors.
29. The broader and higher ascending ramus of the lower jaw.
30. The total absence of the prominence of the symphysis forming the chin.

In the form of the premaxillaries and the earlier obliteration of their sutures, the smaller species of Chimpanzee more nearly resembles Man than the great Gorilla does; it seems also to deviate less through the minor development of the canine teeth, and of the parietal and sagittal crests; but it has been shown, in the comparison of the skulls of the *Troglodytes Gorilla* and *Troglodytes niger*, § 3, that the latter departs in more numerous and important particulars further from the Human type.

§ 7. *Concluding Observations.*

There finally remains for consideration the import and value of the differences which have been pointed out between the great Chimpanzee—the most anthropoid of all known brutes—and Man, in regard, more especially, to the often-mooted and lately-revived hypothesis of the origination of the species of animals by gradual transmutation of specific characters, and that in a progressive or ascending direction.

It would be argued, in the spirit of that hypothesis, that the gradual cessation of combative habits in successive generations of the Chimpanzee might be attended with a diminution in the size of the canine teeth, and a concomitant subsidence of those cranial cristæ that are developed to increase the surface of attachment of the muscles of the jaws; whilst the cranial chamber might gradually expand under the influence of circumstances inducing such peaceful habits, and tending to improve the instincts and develope those psychical powers that dawn in the anthropoid apes, and the manifestations of which have been observed, always with interest and sometimes with astonishment, in the young specimens of the Chimpanzees and Orangs that have been brought alive to Europe.

It is a well-established fact in human physiology, that the skeleton may be modified to a certain extent by the action of the muscles to which it is subservient. By the development of the processes, ridges and crests, and also by the general proportions of the bones themselves, especially those of the limbs, the anatomist judges of the muscular power of the individual to whom a skeleton under comparison has appertained.

The influence of muscular actions in the growth of bone is more strikingly displayed in the change of form which the cranium of the young carnivore or the sternum of the young bird undergoes in the progress to maturity ; not more so, however, than is manifested in the progress of the development of the cranium of the Chimpanzee itself, which results in a change of character so great as almost to be called a metamorphosis.

In some of the races of the domestic dog, the tendency to the development of parietal and occipital cristæ is lost, and the cranial dome continues smooth and round from one generation of the smaller spaniel, or dwarf pug, *e. g.* to another ; whilst in the large deer-hound those bony cristæ are as strongly developed as in the wolf. Such modifications however are unaccompanied by any change in the connections, that is, in the disposition of the sutures of the cranial bones ; they are due chiefly to arrests of development,—to retention of more or less of the characters of immaturity : even the large proportional size of the brain in the smaller varieties of house-dog is in a great degree due to the rapid acquisition by the cerebral organ of its specific size, agreeably with the general law of its development, but which is attended in the varieties cited by an arrest of the general growth of the body, as well as of the particular developments of the skull in relation to the muscles of the jaws.

No species of animal has been subject to such decisive experiments, continued through so many generations, as to the influence of different degrees of exercise of the muscular system, difference in regard to food, association with Man, and the concomitant stimulus to the development of intelligence, as the dog. And no domestic animal manifests so great a range of variety in regard to general size, to the colour and character of the hair, and to the form of the head as it is affected by different proportions of the cranium and face, and by the intermuscular crests superadded to the cranial parietes. Yet under the extremest mask of variety so superinduced, the naturalist detects in the dental formula and in the construction of the cranium the unmistakeable generic and specific characters of the *Canis familiaris*. This and every other analogy applicable to the present question justifies the conclusion that the range of variety allotted to the Chimpanzee under the operation of external circumstances favourable to its higher development would be restricted to differences of size, of colour and other characters of the hair, and of the shape of the head, in so far as this is influenced by the arrest of general growth after the acquisition by the brain of its mature proportions, and by the development, or otherwise, of processes, crests and ridges for the attachment of muscles. The most striking deviations from the form of the human cranium which that part presents in the great Orangs and Chimpanzees result from the latter acknowledged modifiable characters, and might be similarly produced ; but not every deviation from the cranial structure of Man, nor any of the important ones upon which the naturalist relies for the determination of the genera *Troglodytes* and *Pithecus*, have such an origin or dependent relation. The great Chimpanzee, indeed, differs specifically from both the Orang and Man in one cranial character, which no difference of diet, habit or muscular exertion can be conceived to affect.

The great prominent supraorbital ridge, for example, is not the consequence or concomitant of muscular development; there are no muscles attached to it that could have excited its growth. It is a characteristic of the cranium of the genus *Troglodytes* from the time of birth to extreme old age: by the prominent supraorbital ridge, for example, the skull of the young Chimpanzee with deciduous teeth may be distinguished at a glance from the skull of an Orang at the same immature age; the genus *Pithecus*, Geoffr., being as well recognised by the absence, as the genus *Troglodytes* is by the presence of this character. We have no grounds, from observation or experiment, to believe the absence or the presence of a prominent supraorbital ridge to be a modifiable character, or one to be gained or lost through the operations of external causes, inducing particular habits through successive generations of a species. It may be concluded therefore that such feeble indication of the supraorbital ridge, aided by the expansion of the frontal sinuses, as exists in Man, is as much a specific peculiarity of the Human skull, in the present comparison, as the exaggeration or suppression of this ridge is respectively characteristic of the Chimpanzees and Orangs.

The equable length of the human teeth, the concomitant absence of any diastema or break in the series, and of any sexual difference in the development of particular teeth, are to be viewed by the light of actual knowledge as being primitive and unalterable specific peculiarities of Man.

Teeth, at least the ordinary dentine of mammals, are not organized so as to be influenced in their growth by the action of neighbouring muscles: pressure upon their bony sockets may affect the direction of their growth after they are protruded, but not the specific proportions and forms of the crowns of teeth of limited and determinate growth. The crown of the great canine tooth of the male *Troglodytes Gorilla* began to be calcified when its diet was precisely the same as in the female, when both sexes derived their sustenance from the mother's milk. Its growth proceeded and was almost completed before the sexual development had advanced so as to establish those differences of habits, of force, of muscular exercise, which afterwards characterize the two sexes. The whole crown of the great canine is, in fact, calcified before it cuts the gum or displaces its small deciduous predecessor: the weapon is prepared prior to the development of the forces by which it is to be wielded; it is therefore a structure fore-ordained,—a predetermined character of the Chimpanzee,—by which it is made physically superior to Man, and one can as little conceive its development to be a result of external stimulus, or as being influenced by the muscular actions, as the development of the stomach, the testes or the ovaria.

The two external divergent fangs of the premolar teeth, and the slighter modifications of the crowns of the molars and premolars, appear likewise from the actual results of observation to be equally predetermined and non-modifiable characters.

No known cause of change productive of varieties of mammalian species could operate in altering the size, the shape and the connections of the premaxillary bones, which so remarkably distinguish the great *Troglodytes Gorilla*, not from Man only, but from all other anthropoid apes. We know as little the conditions which protract the period of the obliteration of the sutures of the premaxillary bones in the *Tr. Gorilla* beyond the period at which they disappear in the *Tr. niger*, as we do those that cause them to disappear in Man earlier than they do even in the smaller species of Chimpanzee.

There is not, in fact, any other character than those founded upon the developments of bone for the attachment of muscles, which is known to be subject to change through the operation of external causes: nine-tenths therefore of the differences which are cited in the summary at p. 413, as distinguishing the great Chimpanzee from the human species, must stand in contravention of the hypothesis of transmutation and progressive development until the supporters of that hypothesis are enabled to adduce the facts and cases which demonstrate the conditions of the modifications of such characters.

If the consideration of the cranial and dental characters of the *Troglodytes Gorilla* has led legitimately to the conclusion that it is specifically distinct from the *Troglodytes niger*, the hiatus is still greater that divides it from the human species; between the extremest varieties of which there is no osteological and dental distinction which can be compared to that manifested by the shorter premaxillaries and larger incisors of the *Troglodytes niger* as compared with the *Trogl. Gorilla*.

The analogy which the establishment of the second and more formidable species of Chimpanzee in Africa has brought to light between the representation of the genus *Troglodytes* in that continent and that of the genus *Pithecus* in the great islands of the Indian Archipelago is very close and interesting. As the *Troglodytes Gorilla* parallels the *Pithecus Wurmbii*, so the *Troglodytes niger* parallels the *Pithecus Morio*, and an unexpected illustration has thus been gained of the soundness of the interpretation of the specific distinction of that smaller and more anthropoid Orang.

It is not without interest to observe, that as the generic forms of the *Quadrumana* approach the *Bimanous* Order, they are represented by fewer species. The Gibbons (*Hylobates*) scarcely number more than half-a-dozen species; *Pithecus* has but two species, or at most three; *Troglodytes* is represented by two species.

The unity of the human species I regard as demonstrated by the constancy of those osteological and dental characters to which my attention has been more particularly directed in the investigation of the corresponding characters in the higher *Quadrumana*, and the importance of the comparison will justify the minuteness with which they have been detailed.

Man is the sole species of his Genus, the sole representative of his Order; he has no nearer physical relations with the brute-kind than those which mark the primary (unguiculate) division of the placental subclass of Mammalia.

Supplementary Note on the Great Chimpanzee (Troglodytes Gorilla, *Savage*, Troglodytes Savagei, *Owen*, Proc. Zool. Soc. Febr. 1848).

Since the communication of my description of the skulls of the great Chimpanzee of the Gaboon district, I have received from an esteemed correspondent, Prof. Wyman, Professor of Anatomy in Harvard University, United States, and a most accomplished anatomist and physiologist, a copy of his description of the parts of the skeleton of the great Chimpanzee which Dr. Savage had taken with him on his return to America, together with a preliminary and highly interesting sketch of the natural history of the species by its discoverer, who proposes to call it *Troglodytes Gorilla*, adopting the term used by Hanno in describing the wild men, or anthropoid apes, which he discovered on the coast of Africa during his famous voyage*.

Prof. Wyman gives dimensions of the skulls of a male and female *Troglodytes Gorilla*, with comparative measurements of a characteristic skull of a Negro, and those of the *Troglodytes niger* and *Simia satyrus* (Sumatran variety, or *S. Abelii*) from my Memoir in Trans. Zool. Soc. vol. i. p. 374; and he sums up the following points as showing that from the *Tr. niger* the *Tr. Gorilla* " is readily distinguished—

" 1. By its greater size;

" 2. By the size and form of the supraciliary ridges;

" 3. By the existence of the large occipital and interparietal crests in the males, and by rudiments of the same in the females;

" 4. By the great strength and arched form of the zygomatic arches;

" 5. By the form of the anterior and posterior nasal orifices;

" 6. By the structure of the infraorbital canal;

" 7. By the existence of an emargination on the posterior part of the hard palate;

" 8. The incisive alveoli do not project beyond the line of the rest of the face, as in the Chimpanzee and Orang;

" 9. The distance between the nasal orifice and the edge of the incisive alveoli is less than in the Chimpanzee;

" 10. The ossa nasi are more narrow and compressed superiorly."

The 5th, 7th and 9th are the characters which are most decisively repeated in the Bristol specimens of the skulls of *Tr. Gorilla*, and are those that are least ascribable to age or the operation of external circumstances tending to produce a stronger variety of Chimpanzee. The value of the character from size is established by the concurrence of the foregoing more fixed ones. The supraciliary ridges are relatively as strongly developed and as prominent in the skull of a female adult *Tr. niger* as in that of the *Tr. Gorilla*, and they are as angular and rough or uneven in the skull of the adult male *Tr. niger* as in that of the adult male *Tr. Gorilla*. The male *Tr. niger* shows also the median prominence between the orbits above the root of the nose.

* See the passage cited at p. 13, 'Falconer's Translation of the Voyage of Hanno,' London, 1797.

In six skulls of *Troglodytes niger* Prof. Wyman found that "the temporal ridges are generally separated from each other by a space varying from half an inch to one or two inches, according to age, but in none of them is to be seen even a rudiment of the interparietal ridge." In the adult, but by the condition of the teeth, not old male *Tr. niger*, described and figured by me, the temporal ridges have met above the obliterated suture, and developed the rudiment of an 'interparietal ridge,' which would probably have risen above its rudimental state had the exercise of the large temporal muscles been longer continued. Processes, ridges and crests dependent upon the stimulus of muscular action for their development, are the seats of most variety, and the least safe or satisfactory osteological marks of specific distinction. In the great males of the *Tr. Gorilla* even a certain range of variety is presented by the skulls of the four adult males, which we are now able to compare.

In the one described by Prof. Wyman the interparietal or sagittal crest is elevated about $1\frac{1}{2}$ inch above the skull, and terminates above in a thin and free edge: in the fine male skull figured, and in the older male's skull, the two temporal ridges, though touching each other at their base, do not coalesce to form a single sagittal crest, but each terminates in a free edge, inclining from its fellow, and neither of them rise to half an inch at their highest part, three inches behind their point of contact.

With regard to the 4th difference, it appears to me that the specific character of the zygomatic arches is best shown by the depth and convex or angular upper contour of the squamosal portion of the arch.

In respect to the 5th difference, Prof. Wyman has well indicated the characteristic forms of the anterior and posterior nares; and the conformity of the four skulls, two males and two females, submitted to his able and scientific scrutiny, in this important character, with the three skulls which I have described, adds to the confidence in its constancy and value. The observed range of variety does not materially affect the well-marked difference of form in the posterior nares. Prof. Wyman finds in the *Tr. niger* that "the transverse diameter of the orifice exceeds that of the vertical, but in the *Tr. Gorilla* the vertical is twice that of the transverse, a condition which results from the elongation downwards of the superior maxillary bones." In one skull of an adult female *Tr. niger*, in the Bristol Museum, the vertical diameter equals the transverse diameter of the posterior nares, and it exceeds it by about one-half only in the three skulls of the *Tr. Gorilla* in the same museum.

With regard to the 6th character, which was pointed out to Prof. Wyman by Prof. Agassiz, it is stated that "in the Chimpanzee the infraorbital canal forms a deep groove, terminating in the sphenomaxillary fissure, its depth remaining uniform to its termination; but in the Engé-ena (*Tr. Gorilla*) the canal becomes gradually less deep from before backwards, and at the fissure is scarcely obvious." In the skull of the female *Tr. Gorilla* examined by me, the infraorbital canal is also shorter and shallower than in the skull of a female *Tr. niger*, but the varieties observable in the condition of this canal in different individuals of the *Tr. niger* are more marked than those above noticed in the skulls of the two species, and induce me therefore to attach less importance to this character as a specific one. In two skulls of adult males of the *Troglodytes niger* in the College of Surgeons, the infraorbital groove as it passes backwards again becomes a canal by the meeting, and in one specimen by the coalescence of the two sides of the groove above the canal for an extent of from two to three lines before it enters the sphenomaxillary fissure. Prof. Wyman indeed notices a similar conformation in an adult cranium of the Chimpanzee belonging to Dr. J. C. Warren of Boston. Now this is a more decided difference from the continuous open groove at the floor of the orbit in the adult female *Tr. niger* than that groove presents in comparison with the shorter and shallower one in *Tr. Gorilla*. I find too that the second character of *Tr. Gorilla* pointed out by Prof. Agassiz,—" from the internal walls of the orbits which recede from each other in descending towards the floor, thus leaving a large pyramidal space for the lodgement of the os ethmoïdes,"—is so much less marked in the female skull of *Tr. Gorilla*, as contrasted with that of *Tr. niger*, as to induce me to view it more in the light of a sexual than a specific modification.

The 7th difference is a good character, and is repeated by each of the skulls of *Tr. Gorilla* examined by me. All the skulls of *Tr. niger* also show the backward projecting point, where the emargination exists in *Tr. Gorilla*.

In regard to the 8th character, the minor relative projection of the incisive alveoli beyond the line of the rest of the face is as characteristic of the three skulls of *Tr. Gorilla* now in England as of the four in the United States, and results from the same comparative shortness of the premaxillary bones, between the nasal orifice and the edge of the incisive alveoli. But the ossa nasi, besides being more narrow and compressed superiorly, are more prominent at that part in *Tr. Gorilla* than in *Tr. niger*, and they are also more expanded and broader inferiorly, and I cannot but regard the most decisive mark of the specific distinction of the *Troglodytes Gorilla* to be the longer persistence of the maxillo-premaxillary sutures, and the evidence thereby given of the peculiar form, development and connexions of the upper portions of the premaxillary bones. It is remarkable indeed, since these sutures remain so distinct in the adult female skull and in two of the adult male skulls in the Bristol Museum, that no trace of them should have been detected in any of the four skulls taken by Dr. Savage to America, in which Prof. Wyman describes the *ossa nasi* as being "firmly co-ossified with each other and with the surrounding bones."

The triangular expanded facial part of the upper end of each premaxillary intervening between the nasal and maxillary bones will always serve to distinguish the cranium of an immature *Tr. Gorilla* from that of a *Tr. niger*.

Table of Dimensions.

	Troglodytes Gorilla.		*Troglodytes niger.*		*Simia Wurmbii.*	
	Adult Male.	Adult Female.	Adult Male.	Adult Female.	Adult Male.	Adult Female.
	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.	in. lin.
Length of the head from the *inion*, or posterior plane of the occiput, to the margin of the incisors	11 4	9 0*	8 0	7 9	10 6	7 6
Length of the head from the *inion* to the fronto-nasal suture	7 5	6 1	5 4	5 3	5 3	4 7
Length of the head from the fronto-nasal suture to the margin of the incisors	4 8	3 9	4 0	4 4	5 7	4 4
Longest lateral diameter of the *cranium* at the post-auditory ridges	6 10	5 6	5 0	4 6	5 8	5 4
Shortest lateral diameter of the *cranium* behind the orbits	3 3	2 4	2 6	2 8	2 9	2 6
Length of the *os frontis*	4 3	†	2 8	2 9	2 6	2 8
Length of the sagittal suture	3 9	†	2 5½	2 6	2 6	2 7
Least distance between the temporal ridges	nil	nil	nil	1 10	nil	0 6
Diameter of the face at the zygomata	6 6	5 3	5 0	4 8	6 9	6 0
Length of the zygomatic *fossa*	2 0	2 0	1 9	1 9	2 6	2 6
Breadth of the zygomatic *fossa*	1 8	1 5	1 3	1 1½	1 6	1 4
Diameter of the face taken from the outsides of the middle of the orbits	6 0	4 8	4 3	4 0	4 6	4 2
Interorbital space	1 3	1 1	0 8	0 7	0 7	0 5
Lateral diameter of the orbit	1 9	1 6	1 5	1 6	1 6	1 4
Perpendicular diameter of the orbit	1 7	1 7	1 3	1 3	1 7	1 6½
Transverse diameter of the nasal aperture	1 2	1 2	1 0	1 0	1 0	1 1
Perpendicular diameter of the nasal aperture	1 5	1 3	1 0	1 1½	1 6	1 6
Distance between the infraorbital *foramina*	1 8	1 4	2 3	2 1	2 0	1 8
Breadth of the alveolar portion of the *maxilla superior*	2 9	2 7	1 6	2 4	2 8	2 4
Distance from the inferior margin of the nasal bone to the inferior margin of the inter-maxillary bones	2 6	2 3	2 5	2 6	3 3	2 7
Length of the bony palate	4 1	3 3	3 0	2 10	4 0	3 3
Distance from the anterior margin of the inter-maxillary bones to the anterior palatal foramen	1 1	0 10	0 10	0 10	1 3	1 3
Antero-posterior extent of the palatal process of the palate bone	1 1	0 9	0 6	0 6	1 0	0 8
Breadth of the crown of the first incisor	0 6	0 5‡	0 5½	0 5	0 7	0 5
Breadth of the crown of the second incisor	0 4½	0 4‡	0 3½	0 3	0 4	0 3
Breadth of the four incisors	1 8	1 6§	1 7	1 6	1 9	1 6
Length of the grinding surface of all the *molares*, the *bicuspides* included	2 7	2 7	1 10	1 9	2 5	2 0
Length of the crown of the upper canine tooth	1 4	‖	0 11	0 7	1 2	0 8
Breadth of the enameled crown of the canine tooth	0 10	‖	0 7	0 4	0 9	0 5
Interspace between the canine and incisor teeth, upper jaw	0 2	0 1½	0 3	0 2	0 3½	0 3
Distance from the anterior margin of the occipital *foramen* to the posterior margin of the bony palate	3 0	¶	2 3	2 4½	2 10	2 9

* To border of premaxillaries. † Not perceptible. ‡ Of the alveolus.
§ Of alveoli. ‖ Tooth absent. ¶ Base mutilated.

DESCRIPTION OF THE PLATES.

PLATE LVIII.

Side view of the skull of the adult male Chimpanzee (*Troglodytes niger*).

PLATE LIX.

Front view of ditto.

PLATE LX.

Base view of ditto.

PLATE LXI.

Side view of the skull of the adult male Gorilla (*Troglodytes Gorilla*), wanting the lower jaw, which is indicated in outline.

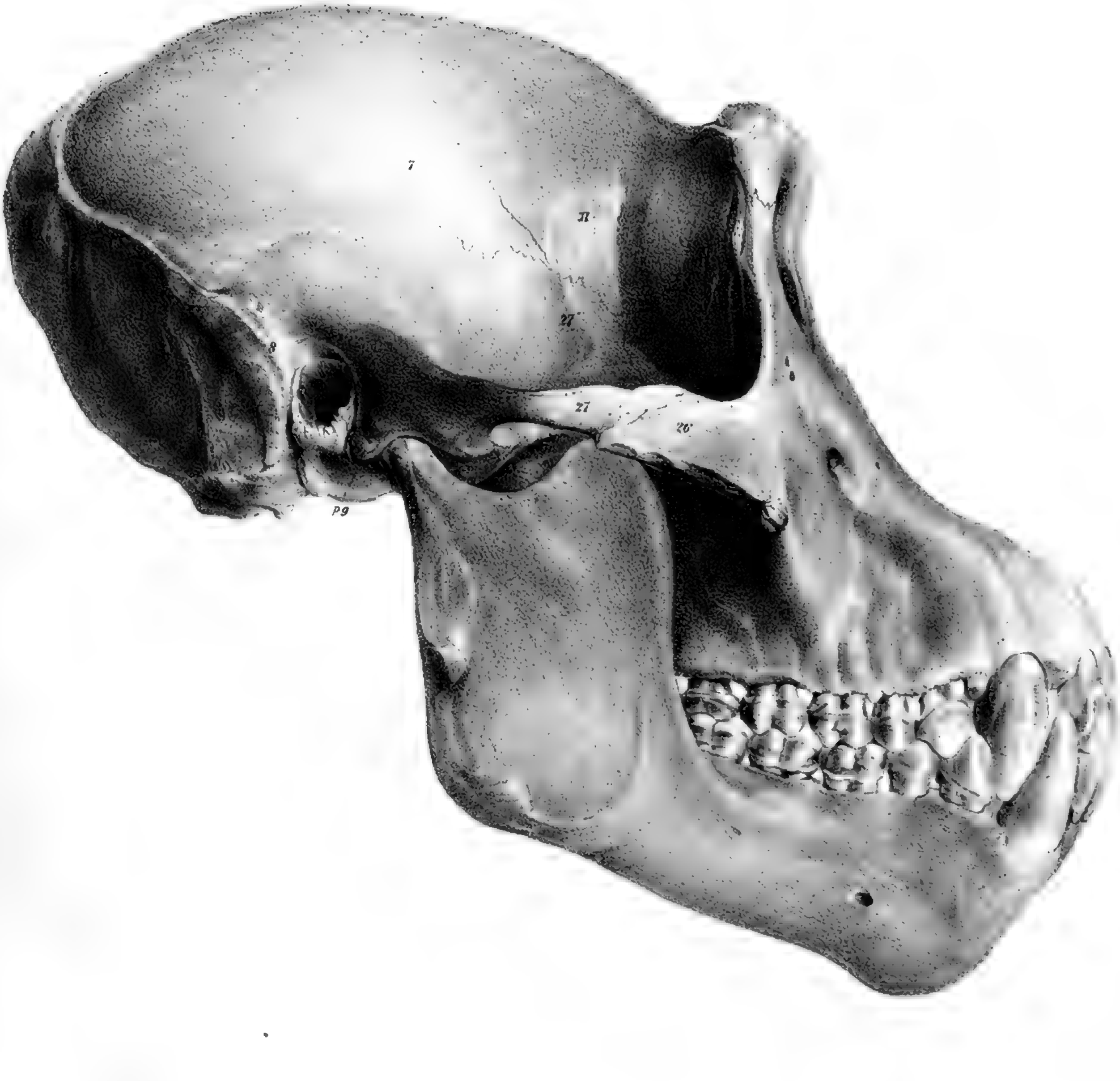
PLATE LXII.

Front view of ditto.

PLATE LXIII.

Base view of ditto.

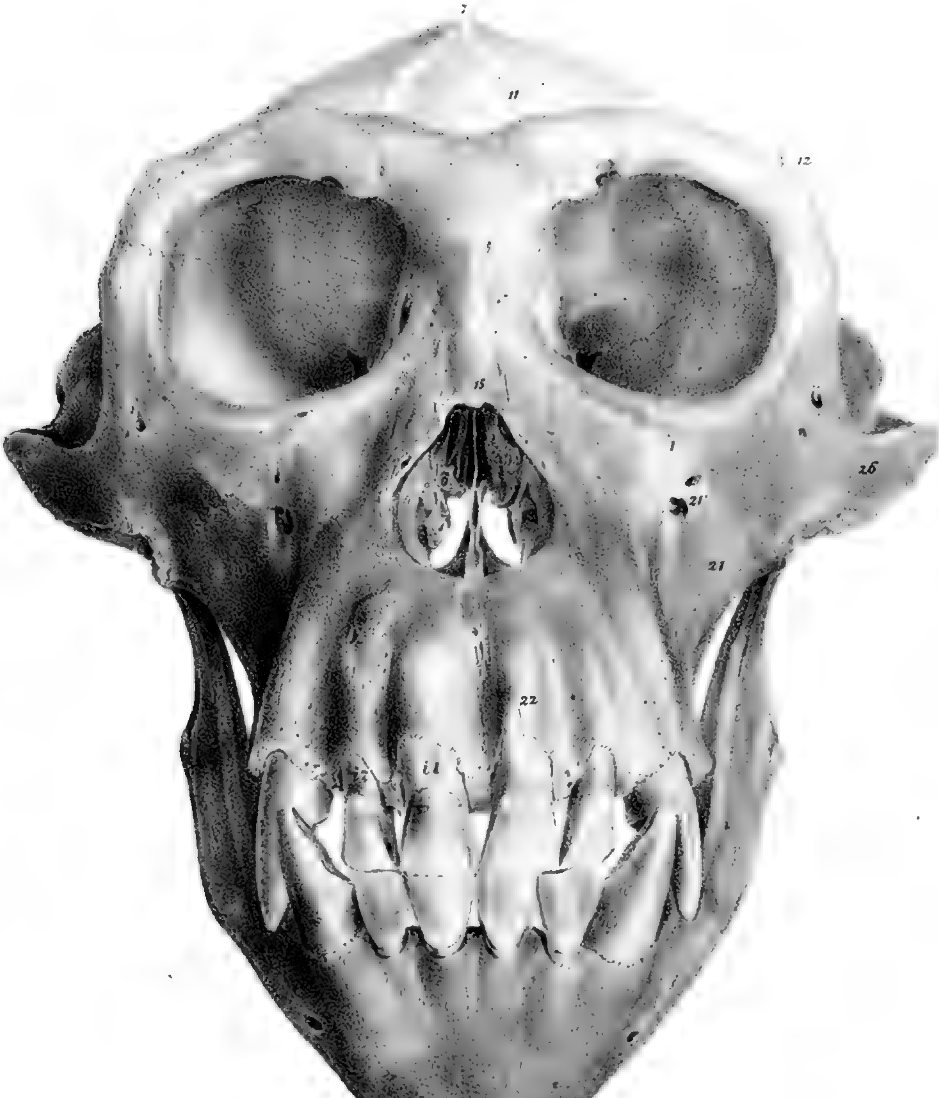
All the figures are of the natural size: the letters and numerals are explained in the text. I beg to express my obligation to the skill and care of the accomplished artist, Mr. Erxleben, for his important aid in the elucidation of the subjects of the present memoir.



From Nature on Stone by J. Erxleben.

Troglodytes niger, mas.
nat. Size.

Day & Son Lithrs to the Queen



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Troglodytes niger mas.

nat. Size.

Day & Son Lith^rs to the Queen

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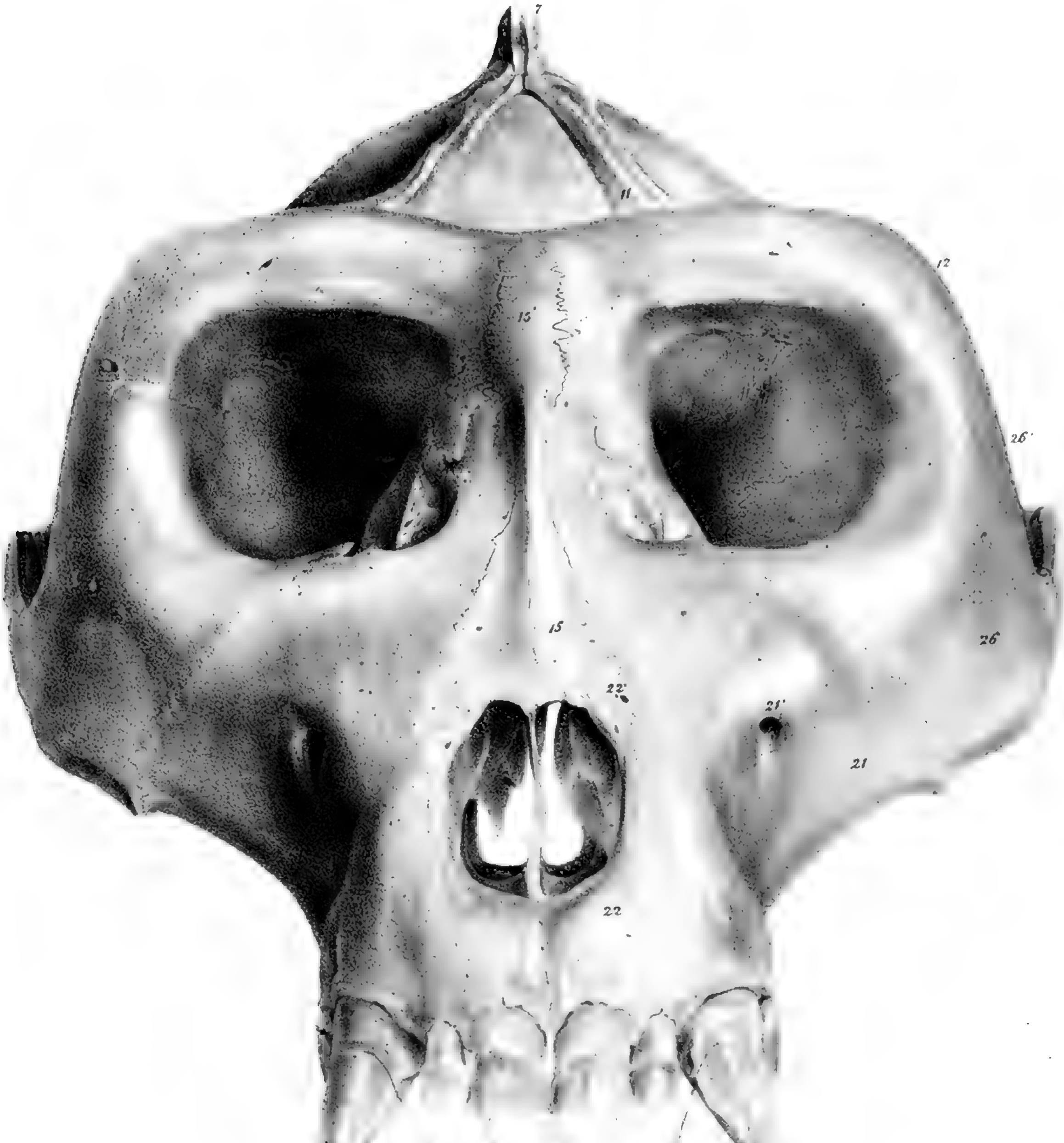
Troglodytes niger, mas.

nat. Size.

Day & Son Lith^rs to the Queen

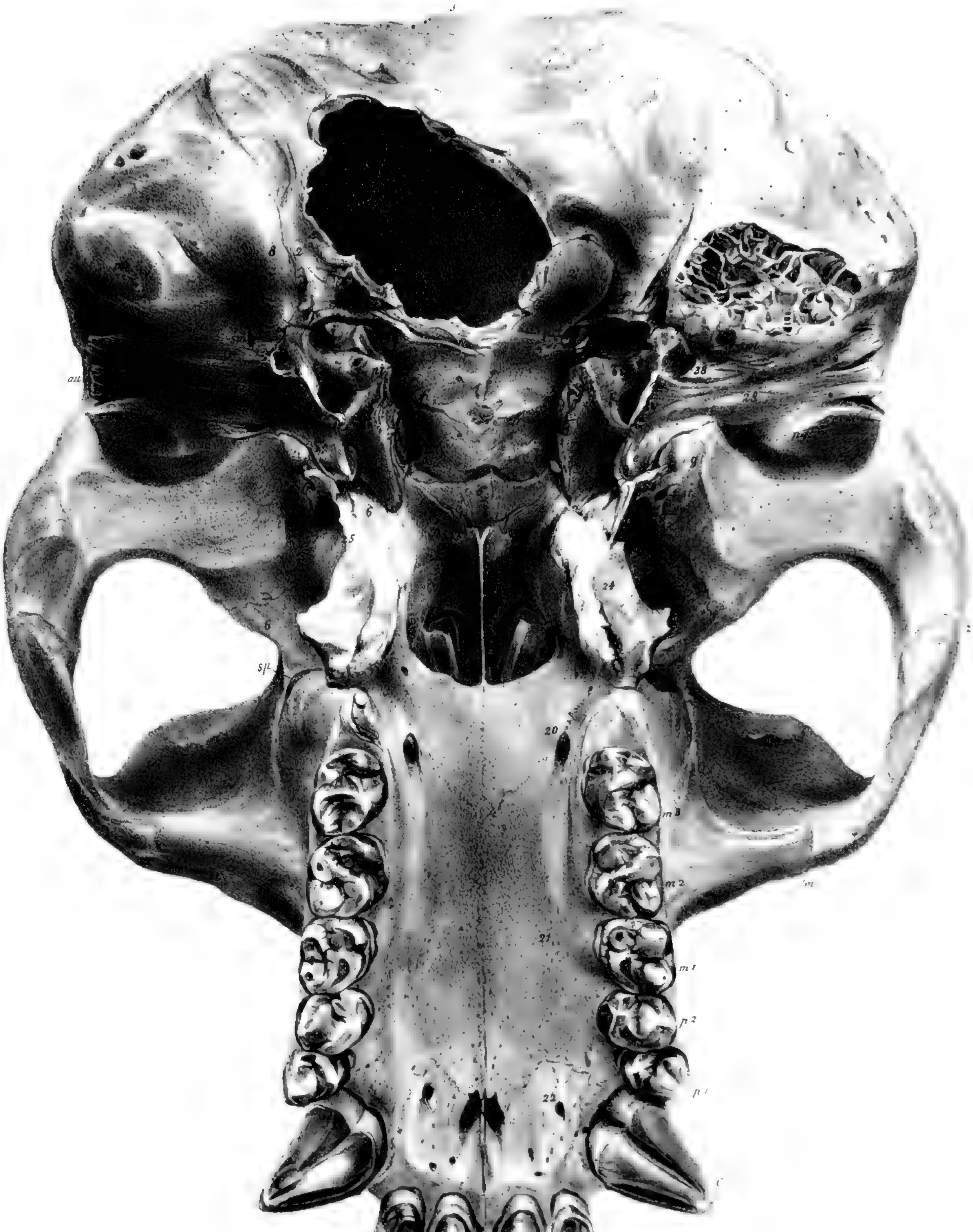
Troglodytes Gorilla. mas



From Nature on Stone by J. Erxleben

Troglodytes Gorilla, mas.
nat. Size.

Day & Son Lithrs to the Queen



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Troglodytes Gorilla, mas

nat. Size

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